

THE EFFECTS OF A PEER-MEDIATED SOCIAL SKILLS INTERVENTION ON THE
SOCIAL COMMUNICATION BEHAVIOR OF CHILDREN WITH AUTISM AT RECESS

By

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Abstract

Children with ASD face enormous challenges in the area of social functioning. Research has shown that impairments in social functioning distinguish this population from both typically developing children and children with disabilities. Fortunately, multiple techniques and intervention packages have been demonstrated to effectively increase appropriate social communication between children with ASD and their peers at school. Another challenge that adults working with children with ASD face is the problem of generalization. Social skills taught during structured social skill groups, for example, may not generalize to natural settings. This study incorporated several social skills-teaching procedures from the literature (direct instruction, priming, prompting, peer-mediation, contingent reinforcement, and token economies) to target social skills for four children with ASD (ages 6-8) directly in the recess setting. Elements of Peer Networks and Pivotal Response Training (two types of social skills intervention packages in the literature) were included. Results show significant increases in social communication between focus children and their peers, as well as generalization of skills to non-intervention recesses.

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Introduction

Impairments in socialization are a core characteristic of Autism Spectrum Disorder (ASD) (American Psychiatric Association, 2000). Some researchers have suggested that these impairments be conceived as the defining characteristic of ASD (Laushey & Heflin, 2000; Hauck, et al., 1995; Fein, Pennington, Markowitz, Braverman, & Waterhouse, 1986; Hobson, 1983; Ungerer, 1989). Others have used differential measures of social/communicative behaviors, first introduced by Wing and Gould (1979), to categorize individuals within this population (Wing & Attwood, 1987; Castelloe & Dawson, 1993; Dawson, Klinger, Panagiotides, Lewy, & Castelloe, 1995; Volkmar, Cohen, Bregman, Hooks, & Stevenson, 1989). These differential measures (aloof, passive, and active but odd) were developed by Wing and Gould (1979) after screening 35,000 children under the age of 15. The researchers found that some children exhibited significant impairments in only one or two of the three domains of the autism diagnosis (social, communicative, and behavioral), and these conclusions led to the conceptualization of autism as a spectrum disorder.

In the following sections, a brief review of the literature on the social impairments of children with ASD is presented. Topics include short and long term effects of social impairments, naturalistic studies of social behavior, instructional procedures in social skills interventions, peer mediation and social skills, generalization and maintenance issues, and the social validity of intervening on social skills. The purpose of the study and related research questions are then presented.

Effects of Social Impairment

For children with autism, deficits in social and communication skills underlie a multitude of challenges with collateral and exponential losses of opportunity across the lifespan (Frea, 1995; Ingersoll, Schreibman, & Stahmer, 2001). McClelland, Morrison, and Holmes (2000), for example, found that interpersonal skill deficits were positively correlated with poor academic performance. Legal mandates of the Individuals with Disabilities Education Improvement Act of 2004 (IDEA, 2004) require that children with disabilities are provided with educational placement in the Least Restrictive Environment. Integrated placement can provide a great deal of opportunity for these to interact with their peers. However, the effects of social impairments distinguish children with ASD from both typically developing children and children with other disabilities in integrated settings (Ingram, Dickerson, Mayes, Troxell, & Calhoun, 2007). The evidence suggests that the mere presence of other children in integrated settings is not sufficient to elicit typical levels of social interaction between children with ASD and their peers (Myles, Simpson, Ormsbee, & Erikson, 1993). Furthermore, children with ASD report higher levels of loneliness than their same-aged typically developing peers (Locke, Ishijima, Kasari, & London, 2010; Bauminger, Shulman, & Agam, 2003).

Research has shown that the majority of spontaneous social interactions in integrated classrooms take place between typically developing students; children with disabilities, on the other hand, are often left out (Goldstein, Kaczmarek, Pennington, & Shafer, 1992). Other researchers have found that patterns of social isolation tend to continue without intervention. Ingersoll, Schreibman, and Stahmer (2001) reported that children who isolated themselves early in preschool continued this pattern of social avoidance, communicating less frequently over time than their same-aged peers.

Failure to communicate with peers at school may lead to a multitude of challenges for children with ASD. Light (1988) stated that four social purposes are accomplished through peer-to-peer communicative interactions: “1) the expression of needs and wants, 2) information transfer, 3) social closeness, and 4) social etiquette”. In other words, without social skills, one is left with very little control over one’s environment in a social context. Since the majority of our experience uptake place in social environments, the lack of adequate social behaviors can have long-term and far-reaching effects.

Shopler and Mesibov (1986) suggested that, rather than an inability to learn these skills, children with autism have deficits related to the spontaneity and flexibility of social/communicative behavior. Scott, Clark, and Brady (2000) made the similar claim that social impairment in ASD is not a disability, but a deficiency in the ability to learn as others do. Fortunately, there is sufficient evidence to suggest that social behavior (for individuals with and without autism) is firmly anchored to the social and physical environment (Ostrosky, Kaiser, & Odom, 1993; Zanolli, 1997). Therefore, a strong rationale exists for the development of environmental stimuli that can directly and desirably shape and control social behaviors.

Naturalistic Observations of the Social Behavior of Children with ASD

There is a body of naturalistic, observational, and self-reported research that provides information on the social behavior of children with ASD in integrated settings. The findings reported in this literature have far reaching implications, from the differences between the social behavior of children with ASD and their peers to the levels of loneliness reported by these children.

Locke, et al. (2010), for example, were interested in whether there was a relationship between ASD and self-reported levels of loneliness. To examine this, they distributed questionnaires to 7 high school students with ASD and 13 neurotypical comparison students. More than 70% of the students with ASD were either peripheral or socially isolated in their classroom social structure, while 90% of the comparison students were “significantly connected and recognized”. The results of self-report questionnaires showed that respondents with ASD reported significantly higher levels of loneliness than their neurotypical peers. The children in the ASD group also had “significantly poorer friendship quality in companionship and helpfulness”, and “significantly lower social network status” than comparison students. These measures, though they provided some insight, had a small n size and failed to control for the differences between respondents. Because impairments in socialization are a core deficit of ASD (American Psychiatric Association, 2000), it is possible that individuals with ASD would respond to the word “loneliness” differently than neurotypical respondents. This possible confounding variable between the groups may have had an impact on the measures’ comparability. Bauminger, Shulman, and Agam (2003), however, examined the understanding of feelings of loneliness in 18 high-functioning children with ASD and 17 neurotypical peers matched for chronological age, IQ, maternal education, and gender. Respondents with ASD and neurotypical students demonstrated an equivalent understanding of social interaction and loneliness. On measures of understanding of the relationship between the two, however, respondents with ASD scored significantly lower.

In addition to their self-report measures, Bauminger, et al. (2003) directly observed the social interaction behaviors of children with ASD in natural environments to learn more about the social context of behavior. Bauminger, et al. (2003) observed the spontaneous social

interactions of their neurotypical respondents and those with ASD during highly social times such as lunch and recess. The children with ASD spent about half as much time engaged in social interaction as their neurotypical counterparts, despite high levels of self-reported loneliness. Both groups tended to allocate the majority of their interactions to neurotypical students rather than peers with disabilities, revealing that children with ASD are rejected not only by neurotypical peers, but by the entire population of children at school (including each other).

Many other researchers have presented findings with similar implications. Koegel, Koegel, Frea, and Freeden (2001) found that both neurotypical children and children with ASD displayed similar levels of child-adult interaction in an integrated preschool classroom, but that children with ASD interacted with peers significantly less than their neurotypical classmates. In their discussion of these findings, the authors stated that, “overall, the major difference between children with autism and their typically developing peers appears to be related to peer social interactions.” McGee, Feldman, and Morrier (1997) found that children with ASD spend less time in proximity to other children, and both receive and make fewer social initiations than their typically developing peers. Furthermore, direct observation research has shown that joint attention, a pivotal and foundational social skill, occurs at unusually low levels in children with ASD (Lewy & Dawson, 1992; Mundy, Sigman, & Kasari, 1990; Sigman, Mundy, Sherman, & Ungerer, 1986; Stone & Caro-Martinez, 1990; Ungerer, 1989; Wetherby & Prutting, 1984; Pierce & Schreibman, 1995; Pierce & Schreibman, 1997). Joint attention is the ability to communicate with others by shifting one’s focus from interaction partners to an object or event to which all are attending (Hobson, 1989). Guralnick and Weinhouse (1984) conducted a short-term longitudinal study in which they collected detailed, descriptive data on the spontaneous

interactions of three groups of preschool children (n=111): one group of neurotypical children, another with moderate developmental delays, and a third with more severe developmental delays. Interaction remained high and stable for the neurotypical group over the course of the study. The moderately delayed children showed increases in communication, but did not reach the levels of their neurotypical peers. Communication levels of the group with more severe delays, however, remained low throughout the year. Another finding of the study was that social bids by children in both delayed groups were met with positive reactions only about half of the time, and rarely led to longer or higher quality social interactions. Play behavior for both groups, although generally appropriate, was simpler or more exploratory in quality than the play behavior of typically developing peers. Both groups with developmental delays engaged in higher levels of solitary or parallel play than their neurotypical counterparts throughout the year. Additionally, terminal levels for both groups remained significantly lower than that of their typically developing peers', despite the fact that the second group's increases in communication were met with increased positive peer reactions. When matched for developmental level rather than chronological age (most 5 year old delay group participants were on the developmental level of a typically developing 2.5 or 3 year old), participants were found to spend less than half the amount of time engaged in play groups than comparison 2.5 and 3-year-old children. These 2.5 and 3-year-old children also spent up to 25% of their time engaged with play groups, 14-25% of which was spent engaged in cooperative play. Children in the delayed groups did not engage in cooperative play at all. "Perhaps the most striking finding of this study," the authors noted, "were observations indicating the existence of unusually marked deficits in the peer-related social interactions of developmentally delayed preschool children." Guralnick and Groom (1987) observed the spontaneous social interactions of 3 groups on a preschool playground: (1)

neurotypical 4-year-olds, (2) mildly-delayed 4-year-olds, and (3) neurotypical 3-year-olds matched to the delayed group for developmental level. Across groups, the results showed roughly equivalent frequency and proportional distribution of social behaviors as well as levels of engagement across various categories of social participation. The play behavior displayed by the typically developing children, however, was more complex than that of children in the delayed group. The delayed group children displayed considerably more solitary play behavior than children in the other groups. Typically developing children tended to allocate their time and attention to interactions with peers matched for age, whereas the mildly-delayed group showed a preference for younger, non-disabled interaction partners. Perhaps the most significant finding was that children in the delayed group were the only participants to show a decline over time in the ability to produce social bids that were followed by positive outcomes. This finding may provide insight into underlying variables of the tendency for patterns of social isolation to continue over time (Ingersoll, et al., 2001). Boyd, Conroy, Asmus, and McKenney (2011) observed the spontaneous social interaction behavior of eight children with ASD, ages 3-5, in a preschool classroom. The researchers coded behaviors according to their consequences in order to examine patterns of spontaneous behavior by function rather than topography. Results indicated that the majority of communicative behaviors were followed by adult attention, and that most responses to peer initiations led to escape from the social situation. Although behaviors hypothesized to function for access to peer attention were observed, they were rare. The majority of peer-directed social initiations functioned to access tangible reinforcers (i.e., requests for a toy). Children with ASD engaged in social behavior of any kind only 6% of the time (about 18 minutes over five hours of observation). Compared to the naturalistic observations of the social interaction behavior of typically developing 3-5 year olds conducted

by Goldstein, Kaczmarek, Pennington, and Shafer (1992), children in this study displayed only 12.5% of the social behavior observed with typically developing children. Hauck, Fein, Waterhouse, and Feinstein (1995) were interested in the differences between the social behavior of children with ASD and same-aged peers with intellectual disabilities. Their results indicated that children with ASD displayed significantly fewer peer initiations than did the children with intellectual disabilities.

The available evidence strongly indicates that children with ASD exhibit significant impairments in social communication, whether compared to neurotypical peers or peers with other disabilities. Furthermore, these children tend to engage in patterns of social behavior that continue or decline over time without intervention. Fortunately, many researchers have addressed this problem, and there are numerous effective intervention techniques reported in the literature.

Instructional Procedures for Teaching Social Skills to be Used with Peers

Shopler and Mesibov (1986) define social skills as “the ability to relate to others in a reciprocally reinforcing manner, and the ability to adapt social behaviors to different contexts.” Brenner and Mueller (1982) found that fluency of social and communication skills are correlated with greater duration of interaction episodes than exchanges without a common focus of attention, or “shared meaning”. Although social skills fluency requires significantly more complex stimulus discrimination and generalization than other life skills tasks, there is sufficient evidence to suggest that such fluency can be taught (Koegel & Koegel, 1995; Whalen, Shrieblman, & Ingersoll, 2006).

Zanolli, Dagget, and Adams (1996) proposed that a social skills intervention designed to promote maintenance and generalization should address five issues. First, the intervention should promote behaviors that occur spontaneously and generalize in the absence of peer or adult intervention (Charlop, Schreibman, & Thibodeau, 1985). Second, social initiations with a high probability of positive peer responses should be taught (Strain and Fox, 1981). Third, the intervention should promote initiation levels that are generally equivalent to those of the participants' neurotypical peers. Fourth, a variety of social skills and initiations should be taught. Finally, the intervention should be designed to ensure feasibility in consideration of teacher, staff, and peer effort (Strain, 1986). Social skills intervention research describes an array of teaching procedures that promote successful social communication behaviors for children with autism. These procedures may be used in isolation, but are frequently used as components of package interventions. The following sections summarize these procedures.

Priming. Priming is “an intervention method that provides a child with a preview of information or activities to be presented” (Wilde, Koegel, & Koegel, 1992). The method is most effective in low-demand situations that, as much as possible, mirror the natural environment (Brookman, Boettcher, Klein, Openden, Koegel, & Koegel, 2003). Priming can involve either a description of upcoming opportunities for the reinforcement of skills or structured sessions in which the skill is actually practiced through role-play. In effect, this procedure creates an establishing operation for the emission of target responses by (a) increasing the salience of upcoming stimuli, and (b) increasing the likelihood that those events will function as discriminative stimuli for target behaviors. Priming also decreases demand for teachers' time and effort, so that they may spend less time attending to the behavior of the focus child, and more time conducting the activity (Zanolli, 1997). Zanolli, et al. (1996) used a priming

procedure with 2 preschool boys with autism and their peers. Before activity sessions, the researchers verbally primed participants to make eye contact and initiate to their peers by requesting attention or tangibles. Peers were trained to praise and reinforce participants' initiations with requested items/actions. During activity sessions, adults prompted peers only. Increases were seen in frequency and variety of spontaneous participant initiations during play sessions that followed the priming sessions.

Prompting. Prompts are “supplemental antecedent stimuli that are provided to increase the likelihood that a desired behavior will occur, but that are not a part of the final desired stimulus to control that behavior” (Martin & Pear, 2003). Prompts generally accompany or immediately follow discriminative stimuli, and are faded as target behaviors are strengthened by reinforcement. There are numerous prompt forms and prompt-fading procedures that have been used successfully in the social-skills intervention literature. These include scripts, time-delay, adult-mediated and peer-mediated prompts, task analyses, and picture and text cues. Liber, Frea, and Symon (2008), for example, taught scripted play skills to 3 children with ASD in non-public school settings using a time-delay procedure. Time delay “...transfer(s) stimulus control from a prompt to the natural stimulus by delaying the presentation of the prompt following the presentation of the natural stimulus” (Cooper, Heron, & Heward, 2007). As the time-delay preceding prompts increased in Liber, et al.'s (2008) study, so did the frequency of participants' spontaneous initiations and other scripted play skills with peers. Two of the three participants reached 100% spontaneous use of scripted social skills, and the third reached 70-90%. In another prompting study, Fox, Shores, Lindeman, and Strain (1986) used a prompt fading procedure to increase spontaneous initiations by teaching behaviors that were likely to be followed by positive peer responses. Examples of such behaviors included verbally organizing

play, sharing, and assisting. Krantz and McClanahan (1993) found that by using scripts and a script-fading procedure, focus children with ASD increased their peer-directed use of initiations during an art project. Scripted initiations included “Ross, I like your picture” and “Would you like more paper?” Focus children were also observed using novel initiations or generalized versions of scripted initiations (e.g., combining elements of different scripts). Data from a two-month follow up showed maintenance of skills as well as generalization across settings with prompts. Sarokoff, Taylor, and Poulson (2001) used textual scripts embedded in snack and activity materials (for example, “Gummi Savers are my favorite” on a package of Gummi SaversTM) to increase the social communication of two boys with autism, ages 8 and 9. Two sets of snacks and a collection of video game cases with embedded text cues were used during snack and activity times with a teacher. Once the scripts were mastered, a script-fading procedure was implemented. Increases in scripted and novel communication were seen across all participants and activities following the completion of the fading procedure. Additionally, increases in communication were observed in the presence of novel stimuli, novel peers, and in the absence of the teachers. In another study involving textual prompts, Thiemann and Goldstein (2001) used a multiple baseline across 2 to 3 social communication skills and replicated across 5 triads to evaluate the effects of a treatment package on the social communication of five children with social impairments (ages 6 to 12) and ten peers from their classrooms. The package included visual text cues as prompts, role-playing, and video-feedback. Each triad consisted of a single focus child and two of his classmates. During baseline sessions, measures of social communication behavior were taken as each triad engaged in 10 min social activities in the library’s media room. During intervention, triads received 10 min of systematic instruction (social story, rehearsal, and role play), 10 minutes of interaction, and 10 min of video-aided self-

evaluation. Results were varied. All participants' showed increases on at least one skill, and increases across all skills were observed with two of the five participants. Additionally, three of the participants' inappropriate behavior decreased following the introduction of the intervention, and an increase in contingent responses (communication behavior that was clearly related to previous peer communications) increased for two of the participants. Shabani, Katz, Wilder, Beauchamp, Taylor, & Fischer (2002) used an ABAB design to evaluate the effects of initiation training and a tactile prompt (a vibrating pager kept in the pocket of participants) on the social initiation and response behaviors of three children, ages 6-7, with autism. Free play sessions involving peers (who were unaware of the participants' social skills training or possession of the pagers) took place at the participants' homes or schools. Increases in initiations and responses were observed with the tactile prompts, but did not maintain during withdrawal conditions. For one of the participants, communication levels remained higher than baseline during a prompt fading condition. Prompting, like priming, is a useful tool for teaching and can be used to supplement the effects of other components in social skills intervention packages.

Initiation training. Many interventions have focused on increasing spontaneous initiation in social settings for children with ASD through direct training (Fox, et al., 1986; Koegel, Kuriakose, Singh, & Koegel, 2012; Oke & Schreibman, 1990; Reichow & Sabornie, 2009; Wichnick, Vener, Pyrttek, Poulson, 2010). Spontaneous initiation is a pivotal skill which can enable these children to better control their environment. Reichow and Sabornie (2009) used social stories to increase the frequency of greeting initiations to peers and adults for an 11-year-old boy with autism. The participant did not appropriately initiate to peers or adults during a baseline and withdrawal condition, but as many as 4 initiations to peers and 6 initiations to adults per 5 min observations were observed during social stories intervention conditions. Using a

multiple baseline design, Oke and Schreibman (1990) compared the effects of three intervention strategies on the social behavior of a child with autism. All 3 interventions involved the teaching of two “approach skills” (sharing and play organizing) and priming children to expect rejection and to keep trying to get other children to play with them. In intervention 1, peers were trained to initiate and maintain social interaction with the focus child, and given reinforcement and feedback for use of trained skills. In intervention 2, the same peers were trained to discriminate between parallel and cooperative play, and then given the same set of contingencies during play time. In the third intervention, the contingencies for the peers were removed, and the focus child was given the same training and contingencies that peers received in Intervention 1 plus role-playing and priming sessions before each observation. In Interventions 1 and 2, an immediate increase was seen in the social interaction behavior of the focus child. However, these changes quickly returned to baseline levels during reversal phases. In Intervention 3, the increases were significant and immediate, and maintained during reversal conditions. Collateral decreases across disruptive behaviors were also seen only during Intervention 3.

Contextual support. While it has been suggested that children with ASD may not be intrinsically motivated to play with or spend time in proximity to their peers (Brown & Murray, 2001), research has shown that with specific and mild environmental changes, communication and interaction can increase with little adult interference or contrived reinforcement. Koegel, Werner, Vismara, and Koegel (2005) described one such intervention, known as Contextual Support (or “circumscribed interests”) intervention. Contextual Support interventions involve adult-organized social opportunities which revolve around the interests of the child with ASD and include neurotypical peers with shared interests. In Contextual Support interventions, parents and teachers of the participant(s) are consulted by implementers to develop a list of

circumscribed interests and appropriate peers. By providing access to interest-related reinforcing materials contingent upon social communication, researchers have seen increases in reciprocal interaction, number of future play-date invitations from peers, positive affect, inferred enjoyment and interest, and collateral decreases in social avoidance behaviors during activities (Koegel, Vernon, Koegel, Koegel, & Paullin, 2012; Baker, Koegel, & Koegel, 1998; Kennedy & Ikonen, 1996; Koegel, Dyer, & Bell, 1987). Other studies have focused on incorporating the circumscribed interests of children with autism into inclusive social settings. Baker, et al. (1998), for example, found that social interaction with peers in natural settings increased when the games being played incorporated the interests of children with ASD. Koegel, et al. (2012) created school clubs incorporating these interests, and reported increased social interactions during club meetings when compared to interactions in natural settings.

The evidence suggests that Contextual Support increases interaction in contrived settings, but it may not prepare participants for social situations in which their circumscribed interests are contextually inappropriate. Ostrosky, Kaiser, and Odom (1993) suggested that target behaviors reflect and mimic those behaviors of the typical peers present in the context of the intervention. Perhaps a combination of these strategies could lead to beneficial outcomes across settings and activities.

Incidental teaching. Incidental teaching, one of the first naturalistic teaching procedures ever developed, refers to a procedure in which a mediator takes advantage of teaching opportunities that arise in loose or unstructured settings (Allen & Cowan, 2008). In a reinforcer-rich environment, the adult follows the child's lead. When the child shows interest in an item or activity, the mediator uses prompts, environmental arrangements, and contingent reinforcement

to elicit appropriate requests or access-function behaviors (Hart & Risley, 1975). For example, a teacher may place an item that has historically been a powerful reinforcer just out of reach of the learner. The adult may then make access to that item contingent upon the prompted or spontaneous use of appropriate requests. Comparisons of incidental teaching and traditional discrete-trial training procedures have shown superior generalization of language skills learned during incidental teaching phases and more spontaneous use of learned skills (McGee, Krantz, & McClanahan, 1985). Although not originally used with the ASD population, incidental teaching has been used to teach children with ASD language skills such as preposition use (McGee, et al., 1985), adjective use (Miranda-Linne & Melin, 1992), and manding (Rogers-Warren & Warren, 1980; Halle, Baer, & Spradlin, 1981). Because it promotes maintenance and generalization, and it allows for the spontaneous selection of target behaviors based on current environmental stimuli, incidental teaching is a valuable component of natural setting-social skills interventions.

Kohler, Strain, Hoyson, and Jamieson (1997) offer a list of spontaneous judgments to facilitate incidental teaching and the use of peers when teaching children with autism: “(1) What action, theme, or material is the focal child interested in right now? (2) If the child is not showing some interest or engagement, then how might I occasion this? (3) What type of IEP skill might be addressed within the context of the child’s current actions? (4) What types of antecedents and/or consequences are natural and effective for facilitating this skill? (5) How might peer modeling, cooperation, or verbal exchanges be incorporated into the teaching process? And (6) what is the best way to set up or facilitate this peer interaction?” Designing a peer-mediated intervention with these questions in mind involves developing procedures that will foster choice during the intervention and contriving contingencies that will promote targeted levels of appropriate behaviors.

Self-monitoring/task analysis. Interventions involving behavioral checklists such as self-monitoring, peer-monitoring, and task analyses have been shown to result in increased interaction between children with autism and their peers (Bryan & Gast, 2000; Koegel, Koegel, Hurley, & Frea, 1992; MacDuff, Krantz, & McClanahan, 1993). Parker and Kamps (2011), for example, found that skills such as playing games, making snacks, and ordering food taught with task analyses maintained after supports were faded for two 9-year-old children with ASD. Additionally, the authors noted an increase in appropriate peer-directed language during activities. Morrison, Kamps, Garcia, and Parker (2001), in a comparison of peer-monitoring vs. self-monitoring, found that focus children showed relatively equal changes in requesting, commenting, initiating, and sharing during social groups. These results suggest that the selection of monitoring agents in a social skills intervention may be made based on the strengths of specific participants or peers, and that either method can result in increased, independent use of skills.

In summary, a variety of strategies and teaching procedures, including priming, prompting, contextual support, self-monitoring, and task analysis, have all been effective in increasing the social and communication behaviors for children and adolescents with ASD.

Peer-Mediated Social Skills Interventions

Peer-mediated interventions (PMIs) involve training peers to implement elements of behavioral interventions. Peer-mediated social skills interventions involve training peers to model, initiate, prompt, and/or reinforce social behaviors and interactions with target children (Thiemann & Goldstein, 2004; Kamps, et al., 2002; Pierce & Schreibman, 1995; Odom & Strain, 1986; Strain & Kohler, 1999). Adults' involvement is generally peripheral, and involves

prompting through peers rather than directly interacting with the focus child unless it is determined to be necessary. PMIs have been shown not only to produce desirable and reliable changes in the social behavior of children with ASD, but when implemented properly, can result in positive collateral effects such as prolonged maintenance of skills, larger effect sizes than adult-mediated intervention, and generalization across peers, settings, and activities (Kohler, Strain, Hoyson, & Jamieson, 1997; Strain & Kohler, 1999). PMI is considered an evidence-based practice by the National Professional Development Center on Autism Spectrum Disorders (<http://autismpdc.fpg.unc.edu/>) and the National Standards Project (<http://www.nationalautismcenter.org>). In peer-mediated social skills interventions, it is the adult's role to set the stage for interaction, and the trained peers' role to provide stimuli that evoke social behavior from the focus child (Odom and Strain, 1986). The following section provides a review of the evidence for the efficacy of peer mediated social skills interventions for children with ASD.

In an early study using a multiple baseline across four 5-8 year-old children with ASD, Egel, Richman, and Koegel (1981) trained peers to model skills for their participants. In the presence of peer models, the researchers observed these children rapidly learning skills reported by teachers to be “difficult to teach with traditional methods”. Skills acquired through peer imitation included color and shape discrimination, as well as receptive and expressive prepositions (on vs. under, for example). Not only did their rate of acquisition and percent of correct responses increase during the peer-model phase, but skills learned in this condition maintained in the peers' absence.

Other researchers have demonstrated the effects of teaching peers specific instructional techniques. For example, using a reversal design, Goldstein, Kaczmarek, Pennington, and Shafer (1992) found a positive correlation between the rates of peer-to-focus-child interactions and focus-child-to-peer interactions in 15 participants ranging from 35 to 82 months old. When implementers trained and prompted peers to interact with focus children at higher rates, focus-child-to-peer interactions increased collaterally. Behaviors included verbal and nonverbal requests (for information, action, clarification, and attention), comments, and responses (general and imitative). Later, implementers were able to fade adult prompts (both to focus children and peers) without significant decreases in the level of either focus child or peer initiations. Blew, Schwartz, and Luce (1985) found that children with ASD successfully acquired a variety of community skills with the tutoring services of trained peers. Zanolli, et al. (1996) implemented a PMI involving priming to increase social behavior in two preschool boys with autism and severe developmental delays. Priming sessions, which involved teachers prompting the participants to initiate to trained peers (e.g., request attention, actions, or access to tangibles), were implemented directly before play activities. During play activities, teachers' prompts were withdrawn. The results of play observations following priming sessions showed increases in participants' rates and variety of spontaneous social initiations. Intervention levels maintained for the focus children while frequency of priming trials and within session adult prompts were systematically faded. The authors also found that through praise and reinforcement of peers' use of the trained skills, they were able to indirectly impact the social behavior of the target children while providing them with non-contingent reinforcement and group praise for positive social interactions. Zanolli (1997) conducted a further investigation of priming techniques on the same behaviors, by comparing two types of priming sessions (sessions that included either "rapid" or

“slow” prompting) during priming sessions. Although the percentage of correct responses were equally high during priming sessions in both conditions, rapid prompting resulted in more consistent, less variable changes during play sessions. Interestingly, before Zanolli demonstrated the relationship between intervention technique and behavior, teachers in the focus children’s classrooms had attributed variability in rates of responding across sessions to medication issues or the child’s mood. Using peer training and teacher prompting strategies, Odom, Chandler, Ostrosky, McConnell, and Reaney (1992) observed increases in percent of intervals including social communication between preschool children with disabilities and kindergarten-aged trained peers. Direct measures included peer and participant initiations and responses as well as reciprocal social interactions (3 or more turns between communication partners). The changes observed by the researchers maintained over a brief maintenance period (4-5 sessions) after prompts had been faded. In addition to the maintenance of participant behaviors, peers maintained their use of communication facilitation strategies during the maintenance period as well. These strategies included sharing, requesting that items be shared, play organizing, assisting, and persistence. Thiemann and Goldstein (2004) trained peers to prompt five first and second graders with ASD using text cues and scripts. The researchers found that their participants had variable, but present, interaction during baseline. With the introduction of peer-mediated prompting, participant communication increased for 3 and stabilized for 2 participants. Ostrosky and Kaiser (1995) trained peers to use social communication facilitation strategies with children with disabilities. The peers were trained to use five strategies (mirroring, assistance, choice-making, descriptive talk, and responding) by role playing scripted interactions with adults in the absence of participants. During role-playing sessions, adults would present opportunities for the peers to use the strategies with increasing levels of difficulty (that is, the adult would

ignore more of their attempts as they reached pre-determined skill fluency criteria). After the peers had reached a mastery criterion on each of the 5 strategies, they participated in 10 min play sessions with participants. During these play sessions, adults prompted the peers to use the strategies that they'd learned in training. The researchers found that training and prompting peers to use these strategies resulted in increased peer-initiated communication to focus children, duration of time spent in proximity to one another, and positive but variable collateral changes in the frequency of communication attempts by children with ASD.

Despite their status as an evidence-based practice, which teachers are required to use by current legislation (Turnbull, Huerta, & Stowe, 2007), PMIs are not yet commonplace in school settings. Kohler, Strain, Hoyson, and Jamieson (1997) suggested that PMI be part of teaching training programs. In their model, preschool teachers first implemented lessons in a one-on-one, direct instruction fashion with children with ASD during a “naturalistic teaching phase” (a phase in which teachers were allowed to implement their own programs toward IEP goals). Following this phase, researchers trained teachers on the use of peer-mediation for a combination (direct instruction + PMI) phase. Increased communication resulted, and teachers reported high levels of satisfaction with the increases in rate, duration, and number of social skills addressed per session.

Peer Networks interventions. Researchers have also reported success when combining PMI with other evidence-based practices into multi-component intervention packages. Peer Networks is one type of packaged intervention. Social skills interventions using Peer Networks were first reported in the literature in the early 1990's (Haring & Breen, 1992). A Peer Network is a small group of teacher-nominated typically developing peers that includes a focus child with

ASD. Peer Networks interventions typically combine adult instruction and peer mediation, and provide social learning opportunities in integrated settings. These interventions have been shown to result in positive outcomes across a variety of social behaviors. Kamps, et al. (1992) found that regular 20-min Peer Networks social skills groups resulted in increased frequency of communication behaviors, task engagement, and duration of interactions of children with autism with their peers in a first grade classroom. Using similar techniques, Kamps, Potucek, Lopez, Kravits, and Kemmerer (1997) found that responsiveness between children with ASD and their peers was also positively impacted. Each of the three participants had four networks across a variety of school settings (i.e. centers, independent work time, recess, and lunch). Procedures implemented during Peer Networks groups included scripts, peer training, reinforcement, and feedback. Dugan, Kamps, Leonard, Watkins, Rheinberger, and Stackhaus (1995) found that by creating small cooperative learning groups, 2 students with ASD displayed improved academic performance on social studies comprehension and recall tests, task engagement, and peer engagement in a fifth grade classroom. Garrison-Harrell, Kamps, and Kravits (1997) created Peer Networks for three students with autism who used augmentative communication devices. Outcomes of the intervention included increases in their use of augmentative communication devices, expressive language for 2 of 3 participants, social interaction time, & peer nominations (named as friends) of the target students. Gonzalez-Lopez and Kamps (1997) observed increases in frequency and duration of interactions for four kindergarten and first grade children enrolled in a Peer Networks intervention. Targeted social skills included turn-taking, greeting, sharing, requesting, imitating, following instructions, and asking for help. Morrison, et al. (2001) found that, by implementing Peer Networks using games that combined peer-mediation, self-

monitoring, peer-monitoring, and reinforcement, they were able to produce significant increases in the initiations and responses of four children with ASD.

Pivotal Response Training. Pivotal Response Training (or PRT) is another multi-component comprehensive intervention package that combines a developmental approach with ABA procedures to provide behavioral support in naturalistic settings (Koegel, Koegel, Harrower, & Carter, 1999; Koegel, Koegel, Shoshan, & McNerney, 1999). Pivotal responses are behaviors that, once learned, lead to increases in the availability and variety of naturally-occurring reinforcers and opportunities (Bosh & Fuqua, 2001; Rosales-Ruis & Baer, 1997; Koegel & Koegel, 1995; Koegel, et al., 1999; Koegel, et al., 1999; Koegel & Frea, 1993; Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996; Mundy, Sigman, & Kasari, 1990; Mundy & Stella, 2000; Schreibman, Stahmer, & Pierce, 1996). Pivotal Response Training procedures include providing availability of choice or shared choice, using multiple cues so that the attention of the child is on the appropriate stimuli, immediate reinforcement of target skills or approximations, intent to transfer stimulus control to natural stimuli, and multiple interspersed opportunities to emit mastered and acquisition skills (<http://autismlab.ucsd.edu/about/pivotal-response-training.shtml>).

By training school peers to implement PRT techniques, Pierce and Schreibman (1995) found that two 10-year-old children with autism displayed increases across several behaviors, including percent of intervals engaged, frequency of initiations, coordinated and supported joint-attention, and number of words per sentence. There were also collateral decreases in competing behaviors such as solo engagement with objects, non-engagement, and onlooking. Pierce and Schreibman (1997), using a multiple baseline across peers design, replicated their 1995 findings

by training eight 7-8 year old peers to use PRT techniques when interacting with 2 classmates with ASD. Increases in duration of interaction, quality of language (words per sentence), and frequency of focus child initiations were again observed. The focus children did not receive direct training in either study. The authors hypothesized that trained peers provided a context that facilitated language, as opposed to one that required directly teaching entirely new verbal skills. During a follow-up phase, focus children chose to play with a wider variety of toys than during baseline, indicating that peers trained in PRT techniques not only affect the verbal and social behavior of focus children, but their rigidity with circumscribed interests as well.

Peer Mediated Social Skills Interventions at Recess

By receiving intervention in the recess setting, children with ASD learn cooperation, communication, and play skills during the most unstructured and highly social activity of the school day (Harper, Symon, & Frea, 2008). With the proper intervention components, children with autism can learn pivotal social skills (Lang, et al. 2011; Harper, et al., 2007; Koegel, et al., 2012; Baker, et al., 1998; Koegel, Kuriakose, Singh, & Koegel, 2012) in a setting that fosters maintenance and generalization. Additionally, due to the growing focus on standards-based instruction in schools, children have increasingly limited social opportunities at school (Harper, et al., 2008; Lang, et al., 2011; Chiang, 2009). Recess is a prime setting for social skills interventions. However, there is relatively little research on the subject.

Harper et al. (2008) found that fully-integrated third grade children with ASD improved on measures of initiations and turn-taking during recess after the introduction of a PMI consisting of indoor social group instruction by trained peers just before recess. Trained peers used cards containing picture cues, rules, and communication cues as well as contingent praise to

help participants play cooperatively with bean bags, a ring toss game, and a NERF™ basketball hoop during the indoor sessions. Immediately following the indoor groups, peers used prompts and contingent, enthusiastic praise for generalized social skills on the playground.

Koegel, et al. (2012) compared the effects of two interventions on social behavior during recess. During a “facilitated social play without initiations training phase”, research assistants with training in PRT techniques asked children with ASD to choose a game or activity during non-recess, and peers with whom they wished to play. The research assistant then invited the peers to join, and used PRT techniques to facilitate play during recess. During this phase, RAs were asked not to prompt initiations, but to facilitate play in every other way (i.e. turn taking, responses, etc.) The researchers reported positive changes in social engagement, child affect, and unprompted peer-directed initiations across participants. These gains, however, failed to generalize from facilitated to non-facilitated activities at recess. The researchers then implemented a “facilitated social play with initiations training phase” in which RAs used the same techniques as well as prompts to focus children to elicit initiations to peers. Again, increases in communication were reported, but this time, these gains generalized to non-facilitated recess periods.

Buggey (2012) used a multiple-baseline design across participants to evaluate the effects of a video-self-modeling intervention on the social initiation behavior of three 3-4 year old boys with PDD-NOS during preschool recess periods. Video models were created in advance by researchers who prompted peers to “get the child with an ASD to interact with them”, and then edited to highlight appropriate social behaviors. Participants were then shown the videos approximately one hour before recess. In spite of evidence for pre-recess priming (Harper, et al.,

2008) and video-modeling's effects on social skills for children with ASD (Shukla-Mehta, 2010), the results of this study showed no significant changes in levels of physical or vocal initiations on the playground.

Kasari, Rotheram-Fuller, Locke, and Gulsrud (2012) conducted a large-scale comparison of peer- versus teacher-mediated social skills interventions on cooperative game playing skills of children with ASD at recess. The study was a randomized controlled trial conducted across 30 Los Angeles-area general education classrooms with children ages 6-11. Experimental groups consisted of: (a) direct instruction (DI) only, (b) PMI only, and (c) a combination of the two. Skills were taught through task analyses, prompting, and modeling during the peer-mediation interventions. Results of the study showed that the groups that received the PMI (or combined treatment) displayed significant improvements in social network salience (number of peer nominations for belonging to a peer network), number of friendship nominations, teacher reports on rates of social skill use in the classroom, and decreased isolation during observations than children who received DI only. Results were best for children who received both treatments, but the PMI only intervention yielded quicker and greater movement toward more central roles in classroom social networks than DI only intervention. Furthermore, the changes in DI intervention participants' behavior were smaller and did not maintain as long as changes resulting from PMIs. PMI participants showed generalization of social skills and social network salience to the next year, when they were in different classrooms with different peers. DI only participants did not.

Recess is a highly social, largely unstructured part of children's school day, and a great opportunity to learn and use appropriate social communication skills. The paucity of research on

peer-mediated social skills at recess should be a concern of researchers, teachers, and families of children with ASD.

Generalization Issues in Social Skills Interventions

One of the primary goals of social skills interventions should be the generalization of social skills (Zanolli, et al., 1996; Kohler & Greenwood, 1986). Whereas social skills for typically developing children usually generalize without intervention (McMahon, Whacker, Sasso, Berg, & Newton, 1996), the generalization of social skills for children with ASD often presents a challenge (Kamps, et al., 2002; Kamps, et. al., 1997; Pierce & Schreibman, 1995; Gunter, Fox, Brady, Shores, & Cavanaugh, 1988). Socially valid social skills interventions should aim to create behavioral traps, ensuring maintenance and generalization of skills across settings, behaviors, people, and activities. Behavioral traps are created by selecting target behaviors that would normally be met with naturally occurring reinforcing consequences, and teaching them in the environment in which they are to be used. In such a situation, skills are more likely to be controlled by naturally occurring stimuli following the withdrawal of intervention (Stokes and Baer, 1977), thus facilitating maintenance. Despite their proven effectiveness in controlled settings, social skills intervention procedures (or intervention packages) such as priming, prompting, contextual support, self-monitoring, peer-monitoring, task analyses, PRT, and Peer Networks have not consistently demonstrated effective, built-in supports that foster generalization to chaotic social opportunities such as recess.

Many studies using multiple trained peers have reported generalization of social skills. In fact, Pierce and Schreibman (1995) noted limitations in generalization across untrained peers when the intervention involved only one trained peer per participant, and later found greater

generalization when implementing the same intervention with multiple peers (Pierce & Schreibman, 1997). Royers (1995) questioned the use of multiple trained peers, claiming that this technique does not mirror the social environment enough to foster generalization. In Royers' view, children with ASD should be taught social skills directly, by adults, and then allowed to interact with untrained peers. While it is true that not all PMI's involving multiple trained peers have resulted in generalization, some researchers have observed maintenance and generalization across peers and classrooms as well as collateral decreases in challenging behavior such as rigidity with routine (Pierce & Schreibman, 1997; Storey, Danko, Strain, & Smith, 1992). Training initiations has been demonstrated to facilitate generalization and maintenance to the following school year (Koegel, et al., 2012). PMIs and PMI/DI combinations were found to result in the same (Kasari, et al., 2012). Pierce and Schreibman (1997) observed generalization of increases in social skill use to untrained peers when they trained multiple peers and focus children to initiate. There is evidence on the other hand that for some children participating in successful school social groups, social skills do not generalize across settings (Kamps, et al., 2002; Kamps, et al. 1997). Kamps, et al. (1997, 2002) found that, in spite of increases in social communication during indoor Peer Networks social groups, interaction between participants and peers remained low in non-intervention settings. Gunter, Fox, Brady, Shores, and Cavanaugh (1988) found that, using multiple trained peers as multiple exemplars, one of two participants generalized interaction levels across settings and untrained peers. The other did not.

Social skills interventions for children with autism must include programming for maintenance and generalization among its goals to be socially valid. The literature suggests that several strategies are likely to increase generalization including peer training (Kamps et al.,

2002; Pierce & Schreibman, 1997); initiation training (Koegel et al., 2012); and use of multi-component intervention packages such as PRT (Kasari et al., 2011; Koegel et al., 2012).

Social Validity of Social Skills Interventions

Montrose Wolf (1978) wrote that, in order to determine whether a work is of social importance, three levels must be considered: (a) the social significance of the goals, (b) the social appropriateness of the procedures, and (c) the social importance of the effects.

Additionally, these judgments must be made not by behavior analysts, but by the members of the society in which the work is done. The following section addresses the social validity of social skills interventions.

Social significance of goals. Considering that impairments in socialization are a defining characteristic of ASD (American Psychiatric Association, 2006) and that naturally-occurring opportunities for social skill acquisition are insufficient to shape or maintain a repertoire of generalized social skills (Myles, Simpson, Ormsbee, & Erikson, 1993), the targeting of social skills for this population is a socially valid pursuit. Results of indirect measures (Bailey & Winton, 1987; Guralnick, Connor, & Hammond, 1995) indicate that improvements in socialization for children with ASD are in the interest of parents, teachers, typically developing peers, and children with ASD themselves. Furthermore, direct observation data indicate that children with ASD do not spontaneously generate typical levels or quality of communicative behaviors (Myles, et al., 1993), and that interactions between them and their peers are different than interactions between typically developing peers alone (Lefebvre & Strain, 1989).

Social appropriateness of procedures. In order to design a socially valid social skills intervention, appropriateness of procedures must be a priority. Separate considerations for participants, implementers, and staff must be made. Research has shown that, regardless of the outcome, children prefer interventions that teach communication skills to interventions that simply target the reduction of challenging behavior. In a comparison of non-contingent reinforcement techniques and functional communication training (FCT) to teach replacement skills for challenging behaviors, Hanley, Piazza, Fisher, Contrucci, Maglieri (1997) found that both of their participants (ages 4 and 8) with disabilities selected FCT over non-contingent reinforcement when given a choice. These findings were replicated in 2009 in a similar study involving eight typically developing children (ages 3 to 5). Seven of the children consistently chose a DRA procedure in which reinforcement was contingent upon appropriate behavior over a non-contingent reinforcement option. The eighth child was indifferent (Luczynski and Hanley, 2009). Researchers have been successful in designing and disseminating social skills interventions that are cost-effective (Kohler, et al., 1997; Charlop, et al., 1983; Koegel, et al., 2012), reduce the demand on staff (Zanolli, et al., 1996; Ostrosky, Kaiser, & Odom, 1993), closely mirror the setting in which the skills will be most necessary (Charlop, Schreibman, & Tryon, 1983; Ostrosky, Kaiser, & Odom, 1993; Harper, et al., 2008), and are popular enough with teachers that they remain in use after the researchers have left the site (Pierce & Schreibman, 1995; Kohler, Strain, Hoyson, & Jamieson, 1997). Furthermore, the call for evidence-based practices in school settings (IDEA, 2004; Owen-Deschryver, Carr, Cale, & Blakeley-Smith, 2008; Koegel, Matos-Freden, Lang, & Koegel, 2012) and the recess setting in particular (Koegel, et al., 2012; Chiang, et al., 2009; Harper, et al., 2008; Lang, et al., 2011) add

a notable degree of social validity to peer-mediated social skills interventions, particularly during social activities such as recess.

Social importance of effects. Finally, researchers must consider the importance of the effects of their interventions (Wolf, 1978). Perhaps the strongest evidence for the social validity of peer-mediated social skills interventions is that, once the research is completed, schools continue to use them (Kohler, et al., 1997). When asked their opinion, teachers have reported high levels of satisfaction with PMI's implemented in their classrooms (Pierce & Shreibman, 1995 & 1997; Kohler, et al., 1997). Researchers have reported desirable collateral changes beyond the skills targeted such as increased network saliency and reduction of challenging behaviors (Hanley, et al., 2007; Oke & Schreibman, 1990). Furthermore, PMI's have led to positive changes in peers' opinions of target children (Kamps, et al., 1998; Disalvo & Oswald, 2002; Ostrosky, et al., 1993), and increased social opportunities outside of the school setting (Koegel, et al., 2005). Zanolli (1997) demonstrated that behavior changes were tied directly to rates of prompts during priming sessions, whereas before, teachers attributed variability in behavior to mood or medication issues. This demonstration of the effectiveness of a data-driven intervention likely made an impact in how these teachers planned future instruction.

Impairments in social communication are a significant problem for individuals with ASD. Effective instructional practices for teaching social skills such as peer-mediation, Peer Networks, and pivotal response training have been shown to produce socially valid changes in the behavior of children with ASD in social settings. Despite the existing evidence, there is a need for further research and dissemination of such interventions.

Purpose

The purpose of this study was to evaluate the effects of a peer network recess intervention package (PNRI) on the reciprocal social communication behavior of young children with autism and their typically developing peers in a recess setting. The primary research question for the study was: What are the effects of a peer-mediated intervention that includes classwide social skills lessons, priming, adult prompting and feedback, peer prompting and praise, and a token economy on the social communication behavior of children with ASD and their typically developing peers during recess? Secondary research questions include the following: What are the effects of the PNRI on participants' initiations and responses to peers? What are the effects of the PNRI on peers' initiations and responses to participants? What are the levels of adult and peer prompts during the intervention condition? What are the most common forms of communication behavior between participants and peers?

The following sections describe the study and its results.

Methods

Participants

Four children with autism, ages 5 to 8 years old, were chosen to participate in this study. All participants had been diagnosed with an autism spectrum disorder by the age of 5. For each participant, parent consent was obtained in advance. Participants attended public elementary schools, grades K through 2, and were selected based on reports and observations of social behavior deficits in the recess setting (in spite of inclusion in pull-out social skills groups at school). All participants were currently participating in or had participated in and aged out of the Peer Networks Project. The Peer Networks Project is a group-design study examining the effects

of reading and social skills groups in schools on the social and group-responding behavior of children with autism (Kamps, Thiemann-Bourque, Heitzman-Powell, Schwartz, Cox, & Rosenberg, 2012). Over the course of two years (kindergarten and first grade), participants were randomly selected to take part in the experimental group or the assessment-only group. Experimental group participants attended three to five 30 min social groups per week in which they and a small group of classmates were taught social skills through DI, feedback, and reinforcement of skill use. Peer Networks social groups centered around table-top activities (mostly board games and toys), and included a 5-10 min introductory social skills lesson, peer-mediated prompting during a 10-15 min play period, and a token economy reinforcement system. The Peer Networks targeted specific social skills such as “Ask and Share”, “Commenting”, “Turn Taking”, and “Play Organizing”. In addition, experimental participants attended three to five 30 min direct-instruction reading groups per week (*Reading Mastery*; SRA, 2005). Both groups were routinely assessed with several standardized reading, language, and social measures. Andy and Connor, the kindergarten participants of this study, were current experimental group participants of the Peer Networks Project. Sheldon and Donny, the 2nd grade participants, had participated and aged out of the assessment-only group, and were currently involved in a social skills group designed by their Special Education teacher at school.

Participant 1, Andy, was a 6-year, 4-month old Caucasian male with a diagnosis of autism disorder. He was integrated into a regular education kindergarten classroom in a public school with the aid of two rotating paraprofessionals for 100% of the school day. To address academic delays, Andy received 30 min a day of pull-out math enrichment. This was his second year of kindergarten and his second year as a participant in the Peer Networks Project experimental group. Andy participated in Peer Networks social groups three times per week, for

a total of 90 min of direct social skills instruction. He also received four 20-min sessions per week of reading intervention, for a total of 80 min of small group (four to six peers) *Reading Mastery* instruction. Andy's receptive and expressive language was delayed. Speech consisted of 2-3 word phrases that were very difficult to understand due to a physical abnormality of the tongue. Initiations to adults generally consisted of requests for access to preferred items or comments on perseverative topics. Few initiations were directed to peers outside of the social groups. He sometimes responded to peer initiations but mostly ignored them.

Participant 2, Sheldon, was an 8-year, 4-month old Caucasian male with a diagnosis of autism disorder. He spent most of his day in a general second grade classroom with occasional classroom paraprofessional support. In addition, Sheldon participated in two 30 min social group sessions per week led by his special education teacher and two 20 min speech therapy sessions per week. Sheldon had participated in the assessment-only group of the Peer Networks Project and received no project-related Peer Networks intervention during his two years as a participant. Sheldon had a large expressive and receptive language repertoire. During baseline observations, however, his communication generally centered around perseverative interests such as specific video games (e.g. Angry Birds) and television shows (e.g. Mighty Morphin Power Rangers). In addition to perseverative talk, Sheldon frequently sought the attention of adults to tell them that his peers were ignoring him or did not want to talk about his preferred subjects.

Participant 3, Donny, was a 7-year, 10-month old Caucasian male with a diagnosis of autism disorder. He spent most of his day in a general second grade classroom (the same classroom as Sheldon) with occasional classroom paraprofessional support. Donny's pull out

special education services included two 20 min occupational therapy sessions, three 20-min speech therapy sessions, and two 30 min social group sessions with Sheldon and two other special-education peers per week. Donny had also participated in the assessment-only group of the Peer Networks Project during kindergarten and first grade. Donny's receptive and expressive language was slightly delayed. During baseline observations, most of Donny's communication with peers was argumentative or accusatory in nature.

Participant 4, Connor, was a 6-year, 10-month old Caucasian male with a diagnosis of autism disorder. Connor spent the first half of his day in a typical kindergarten classroom with no paraprofessional support, and the last half in a special education preschool classroom. In addition, Connor received 20 min of speech therapy once a week. This was his first year as a participant in the Peer Networks Project experimental group. Connor participated in Peer Networks social groups two times per week, for a total of 60 min of direct social skill instruction and practice. He also received four 20 min sessions per week of small group (three peers) *Reading Mastery* instruction. Connor's expressive and receptive language was slightly delayed. During baseline observations, Connor was generally quiet, but would occasionally label his own actions ("I went down the pole") or respond to peers' initiations in the negative ("No thanks").

Assessment data for participants, collected by research assistants on the Peer Networks Project, is presented in Table 1. Measures included the *Peabody Picture Vocabulary Test 4* (PPVT4; Dunn & Dunn, 2007), the *Social Responsiveness Scale – Teacher Form* (SRS; Constantino & Gruber, 2005), and the *Childhood Autism Rating Scale* (CARS; Schopler, Reichler, & Renner, 1988). The most recent standard scores on the *PPVT* indicated that all participants had average (age-normative) receptive language skills except for Connor, who

scored in the moderately-low range. T-scores on the teacher-rated *SRS* fell in the normal range except for Andy, with a lower rating of moderate. *CARS* standard scores showed the 2nd grade participants (Sheldon and Donny) in the mild-to-moderate range, and kindergarten participants (Andy and Connor) in the severely autistic range.

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Implementers

A number of staff were recruited to implement the PNRI. During brief recruitment meetings, the intervention was outlined in detail and a brief written description was distributed. Implementers were selected based on availability as well as familiarity with the participants and their peers. All were female. In one case (for Andy), the implementer was the participant's paraprofessional and social group implementer. It was her third year working with children with autism in the school setting, and her first year working with Andy. In Connor's case, the implementer was his speech therapist and Peer Networks Project social group implementer. It was her first year working in schools, and her first year working with Connor. Donny and Sheldon, because they were in the same class and therefore had the same recess time and classmates, also had the same implementer. She was the classroom paraprofessional, had three years of experience working in schools, and had worked with Donny and Sheldon since the beginning of the school year. In rare cases in which the implementer was unavailable, intervention sessions were run by research assistants.

Aside from implementer recruitment, staff meetings had several other purposes. The first was to educate teachers and staff on the goals and procedures of the intervention. Additionally,

meetings were used to gather subjective reports regarding participants' interests and dislikes and develop a list of peers who would serve as good volunteers in the teachers' and staff members' opinion. All students in the classes were invited to participate in each recess session (see procedures). Four to five were selected from the volunteers. Finally, staff meetings were held to strengthen rapport (staff were already acquainted with the author through his work on the Peer Networks Project) and address staff questions or concerns regarding the intervention.

Settings

Observations took place at two elementary schools. One school was located in a small college town, and the second was located in a small rural town, both in the Midwest. The recess periods of each participants' class were selected as intervention settings for two reasons. The first was that, in spite of ongoing social skills interventions at school, participants displayed low levels of communication and cooperative play during recess.. The second reason was to remove the need for direct instruction and facilitate the generalization according to strategies presented by Stokes and Baer's (1977) recommendations. Playgrounds included standard equipment such as swings, jungle gyms, basketball courts, balance beams, slides, bridges, and blacktop/gravel fields.

Persons present during recess included the participant(s), the participants' classroom peers, other classes with overlapping recess schedules, research assistants, and two to five teachers and staff (including implementers). Andy was the only participant in the project who had an assigned paraprofessional (also his implementer) during baseline recesses.

Dependent Measures

Measures were taken on several levels during the study. Those included social communication behavior of participants and peers at recess, interobserver agreement, momentary time sample data, and fidelity of implementation.

Social communication behaviors. The primary dependent variables for the study were total communications by the participants directed to their peers (initiations and responses) and total communications by the peers to the participants (initiations and responses). These data were recorded by observers during recess sessions on PDAs using NOLDUS Observer XT (2009) software. The NOLDUS software allowed for the recording of frequency counts that distinguished between participant and peer behavior, whether the behavior was an initiation or a response, and six further initiation/response type modifiers. For example, a code of FI-COM told us that the focus child (F) initiated (I) with a comment (COM). A code of PR-RQ told us that a peer (P) responded (R) with a request (RQ). Each coded behavior was time stamped by an internal timing application programmed into the software. Figure 1 shows the range of dependent variables captured by research assistants using NOLDUS during baseline and intervention sessions.

INSERT FIGURE 1

Table 2 presents operational definitions for NOLDUS dependent variables. These definitions were created for the Peer Networks Project (Kamps et al., 2012). Responses were coded as frequency counts of each behavior and sequences of behaviors. For example, “Do you want to go to the swings?” followed by “Yes” would have been coded initiation/request and response/comment. It is important to note that a behavior was not to be coded until a three second pause followed its offset. The quality of the last part of the response was coded (for

example, a behavior that began with a request and ended with a comment, such as “Do you want to go to the slide? It’s my favorite,” would have been coded as a comment only). Therefore, it was possible (and fairly common) for several peers to be communicating with the focus child for several seconds before a peer behavior was finally coded. Only child-to-child communicative acts that involved a participant were coded. Communication acts between peers or from child to adult were not coded.

INSERT TABLE 2

Data Collection

During recess sessions, research assistants collected NOLDUS data on the behavior of the participant and peers. Observations were 10 min total, and collected two to four times per week depending upon scheduled recess sessions and availability of research assistants. During breaks or times when coaching/feedback were required of the RA, NOLDUS data collection was suspended, pausing the NOLDUS timer. These periods were marked “SUSPENDED” on the printed data sessions

Observation data were collected and saved on a PDA and uploaded into a NOLDUS database. Sessions were then printed (see Appendix) to show the raw, time-stamped NOLDUS data reflecting communicative behaviors. Research assistants divided this raw data into thirty second intervals and, for each interval, recorded whether an FI (Focus Child – the participant-Initiation), FR (Focus Child Response), PI (Peer Initiation), or PR (Peer Response) occurred at any time during each interval. Response type modifiers were not included in the final analysis as they were not referred to in the research questions of the present study or specifically targeted during intervention. The percentage of intervals including initiations, responses and total communicative acts were then calculated using the following formula: number of 30-s intervals

with a communicative behavior divided by the total number of intervals for the session. Most sessions contained 20 intervals (10 min).

Participant modifiers were coded from a sample of the data (three baseline and five intervention sessions per participant). Sample sessions were chosen by dividing the total number of sessions in a condition by three (for baseline) or five (for intervention). The result of that calculation was the number of sessions between sample sessions. For example, Donny had six baseline sessions, so every second baseline session was coded for participant modifiers (six divided by three equals two). Sample sessions were coded for percent of interval including each modifier (comment, request, nonverbal, turn taking, nicety, and play organizer).

Occasional non-intervention probe data were collected during the intervention phase of three of the four participants to determine whether levels of responding were maintaining when elements of the intervention were not present. Opportunities to collect these non-intervention probes during the intervention phases were taken when implementers could not run their session as usual due to personal or job-related issues. The number of non-intervention probes for participants were one, two, two, and zero respectively, as implementers were generally dependable and available to run the intervention. Connor's implementer was available whenever observation was possible, and because of time constraints no non-intervention probes were collected with his group.

Observer training. Prior to baseline data collection, all observers were trained to a minimum of 80% interobserver agreement, practicing with videos of Peer Networks Project social group treatment sessions and baseline videos of children playing during free time. RA's were trained to remain as inconspicuous as possible during observations, but remained close enough to the participant to be able to collect data on social behavior. Participants and their

peers were somewhat familiar with RA's because of their involvement with the Peer Networks Project and regular presence at the school. If asked about their presence at recess, RA's told the children that they wanted to see how children play with each other at recess. As previously mentioned, occasionally a RA ran intervention in the absence of the trained implementer.

Interobserver agreement. Interobserver Agreement was calculated using reliability data collected independently and simultaneously by a second observer at recess, using interval-by-interval IOA calculation (Cooper, et al., 2007). Reliability data sessions were printed and analyzed using the same procedures outlined above (printed Noldus data file, divided into 30-s intervals and scored for occurrence or non-occurrence of social behaviors). The printed and scored reliability session was then compared to the printed and scored primary session for interval by interval agreement. Reliability was calculated on participant initiations, participant responses, total participant communication, peer initiations, peer responses, total peer communication, adult prompts, and peer prompts. An agreement was coded if both the primary and reliability observers agreed for a particular interval on the occurrence or non-occurrence of a communicative behavior. A disagreement was coded if the primary and reliability data within the given interval did not match. The total number of agreements were then divided by the total number of intervals in the session and multiplied by 100. The product of this calculation was the reliability score. Reliability scores across participants, sessions, and dependent variables are presented in Table 3. Means across all baseline sessions (31% of sessions) and behaviors was 93-100%, with ranges from 70-100%. Means across all intervention sessions (28% of sessions) and behaviors was 76-93%, with a range of 15-100%.

INSERT TABLE 3

Interobserver agreement for participant modifiers was calculated in a similar fashion. One of three sample sessions per baseline (33%) and two of five (40%) sample sessions per intervention were coded for reliability for each participant, for a total of 38% of sample sessions with reliability. Interobserver agreement was again calculated using interval-by-interval IOA (Cooper, et al., 2007). Agreements and disagreements were scored on the reliability data sheet according to the primary data. If an occurrence or non-occurrence of a modifier was recorded on both the primary and reliability data sheets, an agreement was scored. Otherwise, a disagreement was scored. The total number of agreements was then divided by the sum of agreements and disagreements to reach the IOA percentage score. Results of IOA calculations for participant modifiers are presented in Table 4. Reliability was high across modifiers, conditions, and participants. Baseline and intervention comments were 88% and 99% reliable. Reliability on all other modifiers across conditions was 100%.

INSERT TABLE 4

Momentary time sampling. Table 5 displays the operational definitions for momentary time sampling behaviors (Engaged, Attempt, and Not Engaged). Momentary time sampling observations were made by the implementers during intervention recesses. These data were not intended to be reported as a measure of participant behavior in the present study. Instead, the procedure was included to ensure that implementers were attending to the level of participant engagement at a minimum of once every minute during recess play sessions. Information gathered prior to the design of the intervention had indicated that potential implementers were concerned that they would not be able to dedicate undivided attention to a single group of children at recess. The inclusion of a momentary time sampling procedure addressed these concerns by setting a feasible minimum requirement. It should be noted, however, that during

interventions across all three schools, implementers were nearly always able to attend to and intervene with the groups significantly more often than this minimum requirement.

INSERT TABLE 5

Fidelity measures. Fidelity measures were taken during 14 observations (25% of sessions) using a recess fidelity checklist. Table 6 shows the fidelity checklist items and specific intervention procedures on which fidelity data were collected. Items were scored as yes or no and related to PNRI procedures (i.e. priming of four key social skills, observing during play sessions, prompting peers to initiate to the participants, use of the momentary time sample procedure to monitor performance, giving feedback and charting points). Fidelity data were calculated by dividing the count of “yes” scores in a given session by the total number of items on the fidelity checklist.

INSERT TABLE 6

Experimental Design

A multiple baseline across participants design was used to assess change in the social behavior of participants across conditions (Baer, Wolf, & Risley, 1968; Kennedy, 2005). The design was selected for its internal validity and ability to demonstrate experimental control. Specifically, the effectiveness of the intervention is demonstrated by contrasting low and stable baseline rates to subsequent increases following the introduction of the PNRI. To further demonstrate experimental control, the intervention was introduced non-concurrently for three of the four participants (Cooper, et al., 2007). The fact that Sheldon and Donny were in the same class, and therefore could not begin intervention non-concurrently, presented a challenge. It was

decided that the need for the intervention outweighed the need for non-concurrent introduction, especially considering that the design still allowed for three non-concurrent replications. Once the intervention had begun for a participant, treatment was not introduced for the next participant until data on the social behaviors of the current participant showed an increase over baseline rates for at least five sessions. Each participant's data were visually displayed using a graphs created in Microsoft Excel (2007). Distinct changes in level, variability, and trend across participants were visually inspected to ensure that positive changes in behaviors (total communication acts) occurred following the introduction of the intervention. Data from repeated observations were also reviewed to show that those changes maintained as long as the intervention was in place.

Baseline procedures. Following staff recruitment, RA's began collecting baseline data. During baseline, children played freely for 15 or 20 min according to school and classroom rules. The number of baseline sessions for the four participants were 13, 7, 6, and 13, respectively. During baseline recesses across schools, communication between adults and children was sparse and was generally limited to verbal reprimands for rule-breaking, redirection, or announcing the end of recess. During baseline recesses, participants generally remained isolated from their peers. This is consistent with the findings of other naturalistic-observation studies regarding the socialization of children with autism (Kasari, et al., 2011; Owen-Deschryver, et al., 2008). Participants' classmates normally broke off into small groups to participate in preferred activities such as swinging, taking turns on the slide or fireman pole, running and chasing, or engaging in imaginary play. Imaginary play, which was typically based on TV shows, movies, or video games, was generally limited to the second graders, while kindergarteners tended to prefer the

functional use of playground equipment and turn taking. Organized activities such as sports or competitive games were notably absent across both schools during recess.

Intervention procedures. The PNRI was a treatment package consisting of several components: classwide lessons, pre-recess huddles, implementer and peer prompting and feedback, whistle stops, post-recess huddles, and class parties. These components included the following behavioral techniques: direct instruction of social skills, priming, peer prompting, token systems, group contingencies, and reinforcement.

Classwide lesson. The classwide lesson consisted of a rationale for the recess groups, a description of recess social skills, a series of role-playing demonstrations, and an explanation of the contingencies of the intervention (class parties that were contingent upon a targeted number of points earned by the groups at recess). During the introduction of the lesson, a poster photographs (one of children playing together on the playground and another of children sitting away from their peers) was used as a visual aid to introduce the concept of cooperative play. Posters listing the Peer Networks Recess Intervention (PNRI) social skills were also used as visual aids to explain each specific skill.

Social skills operational definitions. The specific social skills described during the lesson were (a) *playing together and having fun*, (b) *complimenting and encouraging our friends*, (c) *talking about what we're doing and giving ideas*, and (d) *using names and getting attention*. These skills were chosen for their simplicity and potential broadness of application, and were based loosely on PRT techniques. *Playing together and having fun* was defined as staying near members of the group and making sure that everyone was appropriately involved in the same activity. This skill was selected to encourage proximity of the participants to their peers and to increase the likelihood of social engagement. Examples of *Playing together and having fun*

might have included reciprocal verbal and motor behavior centered around a group-selected activity such as Jungle Explorer, playing tag, or taking turns going down the fireman pole. Non-examples included argumentative communication or solitary play. *Complimenting and encouraging our friends* was defined as persisting in asking friends to play group-selected activities and making positive statements regarding the behavior of group members. This skill was selected to promote participation and persistence, attention to the appropriate social behaviors of group members, and to increase children's use of praise during recess. Examples of *Complimenting* included statements such as "good idea", "nice move", and "you did it". Examples of *encouraging our friends* included statements such as "come on", "you can do it", or "let's catch up with the group". Non-examples included accepting the rejection of invitations to play e.g., "I don't want to play with you", and negative comments such as "you're not fast enough." *Talking about what we're doing and giving ideas* was defined as labeling rules and stating activity-related preferences, as well as providing instructions or suggestions to group members before or during play activities. This skill was selected to increase reciprocal, activity-related communication between participants and other group members, foster cooperation and leadership skills, and to encourage children to combine their interests creatively (for example, if some wanted to play pirates and others wanted to play jungle explorers, they could pretend that a pirate ship crashed onto a jungle island). Examples of *Talking about what we're doing and giving ideas* included choice behavior such as "Let's play Donny's game again" or "we're playing Jungle Explorer, so if you want to play a Pirate let's say that you wrecked your ship and got lost in the jungle". Non-examples might have included argumentative or non-cooperative statements such as "I want to play Pirates, not Jungle Explorer" or "We never get to play my game". *Using names and getting attention* was defined as using friends' names and gestures

(e.g., tapping on the shoulder) to get them to pay attention and to play with the group. This skill was selected to replace inappropriate attention-seeking behavior as well as increase peer-prompted participant engagement. Examples of *Using names and getting attention* included light taps on the shoulder or calling the name of a friend. Non-examples included crowding, grabbing and pulling friends into a group activity, and ignoring unengaged group members. These skills were based on principles of Koegels' Pivotal Response Training (Pierce & Schreibman, 1995), as illustrated in Table 8.

INSERT TABLE 8

Following the introduction of the social skills, the participant and two peer volunteers were guided through two or three role-playing scenarios in front of the class. During these scenarios, peers were encouraged to use targeted social skills and prompts to engage the participant in a short play activity. Descriptive praise was provided to peers and participants, and non-participating classmates were encouraged to applaud the participants' and peers' efforts. After the role-playing, the contingencies of the intervention were introduced to the class.

During each PNRI session, participants and peer volunteers would earn points for using the social skills. The points would be transferred to a visual token economy chart called the Party Chart, which would provide a visual display of progress toward a class party. Regardless of individual class members' levels of participation, all classmates present that day would participate in the party. Figure 2 illustrates the order of the elements during an intervention session, followed by progress toward the class party. Following the figure is a description of each element of the timeline.

INSERT FIGURE 2

Pre-recess huddle. During the pre-recess huddle period, the implementer gathered a group of peer-volunteers by asking who would like to participate in the group. Sometimes, the implementer would approach individuals and encourage them to volunteer, but generally a group of peers would approach the implementer. These volunteers were usually classmates of the participant, but members of other classes were known to volunteer as well. The intervention required a minimum of four peer volunteers per session, but this minimum was often exceeded. Once the group was gathered, the implementer primed peer volunteers and the participant by briefly reviewing the four social skills, providing examples and/or models, and reminding the group of the contingencies of the intervention. This priming generally lasted approximately two minutes, depending on the fluency of the group members with the intervention social skills. The group was then told to go play.

Recess play session and monitoring. Because of the naturally-occurring variety of activities and unpredictable changes in trends seen during typical recesses, it was decided that specific, structured activities would not be enforced during intervention. This created the opportunity for implementers to teach loosely based on current preferences of the children, decreasing the need for generalization of skills across novel activities in the absence of the intervention and increasing the appeal of volunteering. During both 5-min play sessions, the implementer (with her momentary time sampling data sheet) would look up at the end of each 1-min interval to see that the participant's behavior met the definition of "engaged". If not, the implementer would use a peer-mediated prompting procedure (illustrated in Figure 3) until the participant was engaged. Once the participant was engaged, the implementer would again back away and allow the group to play without interference until the participant's engagement lapsed. As mentioned earlier, implementers were usually able to dedicate more attention than was

required by the momentary time sampling data sheet. The prompting procedure in these cases did not apply only to the end of the interval.

INSERT FIGURE 3

Whistle stops. Whistle stops occurred two times during each recess play session during intervention conditions: once at the end of the first 5-min play period, and again at the end of the second 5-min play period. Figure 4 shows a single whistle stop's section of a whistle stop checklist. Implementers carried whistle stop checklist data sheets on their clipboard, which each contained nine of these.

INSERT FIGURE 4

During whistle stops, the implementer gathered the participant(s) and peer-volunteers. Using the whistle stop checklist, the implementer or a peer-volunteer would review each item on the checklist, asking if everybody was using the skills discussed during the lesson. If the answer was “yes”, a check was received on the whistle stop checklist for the corresponding key skill. Descriptive feedback and praise was given to children who had displayed use of the skills during the recess play session. If the answer was “no”, the implementer would take the opportunity to remind the children of how they could earn their checks, and model or role-play the specific skill with the children. This specific, individual and group feedback potentially reinforced activity-related social behaviors for all group members and primed children with examples of desirable behavior for the next recess play session. Whistle stops generally lasted about two or three minutes each.

Post-recess huddles. Post-recess huddles occurred at the end of a recess session (after the second whistle stop). During post-recess huddles, the implementer or a peer-volunteer

transferred points from the whistle stop checklist to a Party Chart. A Party Chart was a visual token economy that showed a group's progress toward the terminal reinforcer (class party). For each participating class, the first class party was contingent upon seven successful intervention recesses. Thereafter, the reinforcement schedule was thinned to eight successful intervention recesses for the second party and 19 successful intervention recesses for the third and fourth parties.

Class party. Over the course of the project, Andy's class earned four parties, Sheldon and Donny's class earned three, and Connor's class earned one. The number of parties was limited for Connor because the intervention was introduced close to the end of the year. Class parties were 10 to 15 min long and consisted of preferred activities, party favors and snacks, and descriptive praise for those who had participated. Specific details of each class party (activities, prizes) were agreed upon in advance by classroom staff and research assistants.

Implementer Training

Before the introducing the PNRI, the author confirmed with implementers and staff that information gathered during the Staff recruitment meeting was still valid and the classwide social skills lesson was scheduled. In vivo implementer training on the intervention procedures began during initial intervention recesses. During training sessions, the researcher modeled and coached the implementer on the following procedures: gathering participants and peer volunteers, pre-recess priming, monitoring the group with the momentary time sampling data sheet, prompting through peers, providing whistle stop feedback, and awarding points during the post-recess huddle. Modeling and coaching continued for three or four sessions until the implementers reported that they felt comfortable implementing the procedure independently.

Following training sessions, fidelity data informed coaching and training throughout the intervention.

Results

Results of the PNRI showed significant increases in social communication behavior across all four participants and their peers. Results will be presented for total communication acts (initiations plus responses for the participants and their peers). Additional results for secondary research questions are then described.

Total Social Communications

Figure 5 shows the percentage of 30-s intervals in which the social communication acts of participants and peers were observed during recess. The top tier shows the percentage of intervals in which social communication was observed for Andy and his peers. Baseline data show low levels of communication across sessions, with an outlying data point for peer communication at session nine. Subjective qualities of this outlying data point will be addressed in the discussion section. Following the introduction of the intervention, data show a rapid increase that remains stable at levels significantly higher than baseline levels throughout the intervention. The open data points represent percent of intervals in which social communication was observed during a non-intervention recess probe. Andy's percent of intervals with social communication during that probe remained high at 90%. The percent of intervals with social communication for the peers was also high at 80%. The second tier shows data for Sheldon and Donny and their peers. Data for both participants indicate low levels of social communication during baseline, with the exception of an outlying data point (session five) with Donny.

Following the intervention, communication rapidly rose and mostly maintained at above-baseline levels. Peer communication for both participants is similar. The open data points show percent of intervals in which social communication was observed during two non-intervention probes during the intervention phase for both participants. Sheldon communicated with his peers during 75% and 90% of intervals respectively, and Donny with his peers during 55% and 95% of intervals respectively. Peer data for the non-intervention probes are at 80% and 90% respectively during Sheldon's non-intervention probes, and 55% and 90% respectively during Donny's. The bottom tier shows levels of Connor's and his kindergarten classmates' communicative behavior. As with the other participants, low rates of communication are presented during baseline, and a rapid, significant increase following intervention. The open data points in the baseline-condition are data from probes taken during recesses with Connor's preschool class. Connor attended kindergarten in the morning and preschool in the afternoon every day. Interestingly, even without intervention, preschool observations produced data consistent with kindergarten intervention session levels. Connor's data during these probes were 75% and 70% respectively, and peer data were 85% and 80% respectively. No non-intervention sessions were observed during Connor's intervention phase.

INSERT FIGURE 5

Table 9 shows means, ranges, and standard deviations for all participant and peer data across conditions. Andy's social communication baseline mean was 9% of intervals, with a range of 0%-35% and a standard deviation of 10. Andy's intervention data showed an increase in communication with a mean of 77%, a range of 40%-100%, and a standard deviation of 16. Andy's peers' data showed a baseline mean of 27%, a range of 0-90% (the 90% being the outlier at session 9), and a standard deviation of 23. Without the outlying data point, the mean would

have been 15%, with a range of 0%-30% and a standard deviation of 12. Observations of Andy's peers during the intervention phase showed an increased mean of 90%, a range of 70%-100%, and a standard deviation of 10. Sheldon's data show a significant increase across conditions in mean percent of intervals including social communication, as do his peers' data. Ranges for Sheldon and his peers narrow slightly, and standard deviation remains about the same. Donny's baseline data are skewed by the outlying data collected at session five. Excluding this outlier, Donny's peer-directed communication would have occurred at a mean of 23% of intervals, with a range of 15% to 35% and a standard deviation of 9. Donny's peer data is similar. Excluding the 90% outlier, peer communication would have occurred at a mean of 23% of intervals, with a range of 10%-35%, and a standard deviation of 10. Connor's data also show a significant increase in mean, as well as a widening of ranges and slight increases in standard deviations across conditions for both Connor's behavior and that of his peers.

INSERT TABLE 9

Initiations

Table 10 shows changes in participants' and peers' initiation behavior across conditions. Participant means all show significant increases during intervention and a general widening of ranges with the exception of Donny, whose outlying baseline data point skews the data. Peer means also show significant increases in means across conditions and a general widening of ranges with the exception of Andy's peers, whose data is skewed by an outlying baseline data point.

INSERT TABLE 10

Figure 6 shows individual session data for initiations of participants and peers across conditions. The top tier shows Andy's data on the left, and Andy's peers' data on the right. Open data points indicate levels of initiations for Andy and his peers during a non-intervention probe. During this probe, Andy was not observed to initiate to his peers. Peer initiations to Andy, however, are significantly higher at 90% than the baseline mean of 20%. The second tier shows Sheldon and Donny's initiations levels across conditions for participants on the left and peers on the right. Sheldon's baseline initiation levels are all below 40% of intervals, whereas during the intervention phase the majority of sessions resulted in data exceeding those levels. Both Sheldon's and his peers' baseline initiation levels show a downward trend during baseline, but with the introduction of the intervention, those levels increased and were consistently above baseline means. Non-intervention data show that Sheldon initiated during 35% and 50% of intervals respectively, and his peers initiated during 65% and 60% of intervals respectively. Initiation data for Donny and his peers also indicate significant increases in level following the introduction of the intervention. Donny's Non-intervention probe data were 20% and 75% respectively and 55% and 65% respectively for peer initiations. During all four second-tier non-intervention probes, peer initiations to the participant were above baseline levels. Participant initiation levels during the second non-intervention probes for both participants also show significant increases from baseline. Participant initiation data from both participants' first non-intervention probes were within the higher range of baseline levels, and Sheldon's falls within the lower range of his intervention data. It is worth noting that the first non-intervention probe for Donny took place toward the beginning of the intervention phase. The third tier shows Connor's initiation levels across conditions on the left and Connor's peers' initiation levels across conditions on the right. The open data points indicate that, even without intervention,

Connor and his preschool peers initiated to each other at higher levels during baseline than did Connor and his kindergarten peers. Connor's initiations during these probes were observed during 45% and 30% of intervals respectively, and peer initiations were at 65% and 50%.

INSERT FIGURE 6

Responses

Table 11 shows the effects of the PNRI on levels of participants' and peers' responses to each other's communication behavior during recess. When inspecting these data, it is important to keep in mind that response rates are not necessarily tied directly to initiations, as a response may follow an initiation or another response (as in a multiple-turn conversation). During baseline, Andy responded to peers during only 5% of intervals on average, with a range of 0-25%. During the intervention phase, Andy's response mean increased significantly to 63% of intervals, with a range of 20-90%. Andy's peers responded to him during only 2% of intervals on average during baseline, with a range of 0-10%. During intervention, their responses increased to 42% of intervals on average, with a range of 15-81%. Response data for the other participants show similar changes in means and ranges across conditions. Sheldon and Donny's response ranges all reflect levels that exceed baseline ranges, and Sheldon's peers' response range exceeds baseline range. Donny's peers' response range during intervention exceeds baseline ranges with the exception of the session five outlier.

INSERT TABLE 11

Figure 7 shows individual session response levels for all participants and their peers. The top tier shows data for Andy and his peers. Baseline levels are low (25% or below for Andy's

responses and 10% or below for Andy's peers). Following intervention, Andy's response levels increase to above baseline levels with two exceptions (Sessions 17 and 21), both of which occurred toward the beginning of the intervention condition. Andy's peers responded at levels above the baseline range as well, with one exception (session 21). Open data points indicate response levels during a non-intervention probe. During this probe, Andy responded to peers during 80% of intervals, and peers responded to him during 45% of intervals. The second tier shows response levels for Sheldon and Donny and their peers across conditions. Both participants responded to peers during 30% of intervals or fewer during baseline with the exception of Donny's outlier. Sheldon's average level of responses during intervention is higher than Donny's, but both participants showed a mean increase across conditions. Peer data for both participants is variable during intervention, in spite of significant increases in peer response means. When inspecting tier two data, it must be understood that both tier two participants were involved in the same group, with interventions being run simultaneously. Regardless of the participant whose data was being collected during any given session, both participants were receiving the intervention simultaneously, and with the same group of peers. These peers' communication behaviors were effectively split between the participants during each intervention session. Open circles show data for two non-intervention probes for each participant. Sheldon responded to peers during 60% and 70% of intervals respectively, and Donny 35% and 85% respectively. Sheldon's peers responded to him during 45% and 65% of intervals respectively, and Donny's peers 5% and 80% respectively. The third tier shows the percent of intervals in which Connor responded to his peers (on the left) and they responded to him (on the right) across conditions. During baseline, Connor responded very infrequently to kindergarten peers, but these responses increased significantly following intervention. Open data

points show that, even in the absence of intervention, Connor responded to his preschool peers at a much higher rate (45% and 65% of intervals respectively). Connor's kindergarten peers responded to him infrequently or not at all during baseline observations, but showed an increase (with a dip toward the beginning of the intervention) during intervention. Data from baseline preschool probes show that preschool peers responded to Connor even more frequently than kindergarten peers sometimes during intervention, at 50% and 60% of intervals respectively.

INSERT FIGURE 7

Responses to Initiations

Figures 8 and 9 show data for initiations that were followed by responses (i.e., not ignored). Figure 8 provides a visual display of the percent of intervals including participant responses and peer initiations. It is interesting to note that, aside from Andy's and Donny's outlying baseline session data points, levels of initiations and responses across child type (focus child vs. peer) tended to mirror each other. This is consistent with research showing a positive correlation between levels of peer and focus child communication levels (Goldstein, et al., 1992). Figure 9 provides a visual display of levels of peer responses and participant initiations. These data also show a positive correlation between peer and participant communication levels.

INSERT FIGURES 8 & 9

Prompt Levels Across Conditions

Table 12 shows the effects of the PNRI on levels of adult-to-participant and peer-to-participant prompts during recess. There were a few instances in which adult and peer prompts

were observed prior to intervention training. However, as can be seen from the data, this was unusual, and happened with significantly greater frequency during intervention.

Adult prompts. During Andy's 14 baseline sessions, he was prompted twice by an adult on the playground, and no more than one prompt was observed during any single baseline recess. During intervention, however, Andy was prompted by an adult to communicate with peers 63 times across 13 sessions. This is a significant increase, with a range of 0-10 adult prompts per session and a mean of 4.8. Of the four participants, Andy was the only one to have been prompted by an adult during baseline. During intervention, Sheldon was prompted by an adult 20 times across 13 sessions, with a range of 0-7. Donny received adult prompting 34 times during his 11 intervention sessions, with a range of 0-6 per session. Connor was prompted 93 times across 10 intervention sessions, with a range of 1-19.

Peer prompts. In addition to prompts from adults, participants were also prompted by their peers to use appropriate social communication behavior. Peer prompts may have been spontaneous, or prompted by the implementer or RA. During baseline, Andy and Connor (the kindergarten participants) both received prompts from peers. Andy received a single peer-prompt during his 14 baseline observations, and Connor received three during a single baseline observation (out of 13 baseline sessions). Neither Sheldon nor Donny (the second grade participants) received peer prompts during baseline. During intervention, Sheldon received three peer prompts across 13 observations- two during one session and one during another- and Donny received no prompts from peers during either condition. For all participants, the levels of prompt frequency per session increased across conditions. Connor experienced the most drastic change

in adult prompt frequency (from 0 prompts per session to 9.3 on average), and Andy in peer prompt frequency (from 0.2 prompts per session to 4.3 on average).

INSERT TABLE 12

Specific Social Communication Skills

Table 13 shows means and ranges of specific social communication behaviors across conditions. These data indicate that comments and requests were the most common form of communication used by all four participants. Both of these communication types increased significantly across conditions for all participants as well. Turn taking behaviors saw minimal changes if any, and in fact decreased slightly with Donny. Nonverbal communication also increased across conditions for all participants. Play organizing communication behaviors were significantly increased for both Donny and Sheldon, the second grade participants, but were hardly present in either condition for kindergarten participants.

INSERT TABLE 13

Comments. Figure 10 shows the mean percent of intervals including comments across conditions and participants. Significant increases in commenting were seen for all participants. Andy's mean commenting data showed the most significant increase, from 2% of intervals during baseline to 50% of intervals during intervention. Although the increase in Sheldon's commenting data is the least significant of the participants, he commented more frequently in both conditions than any other participant.

INSERT FIGURE 10

Requests. Percent of intervals including requests across conditions and participants is shown in Figure 11. Though increases were again seen across conditions for all participants, it appears that much more time was spent commenting during intervention recesses than requesting.

INSERT FIGURE 11

Nonverbal communication. As with commenting and requesting, the PNRI resulted in increased nonverbal communication across all participants. Andy spent more of his time communicating nonverbally than the other participants, which is to be expected considering his verbal skill impairments. Nonverbal communication data across conditions and participants is presented in Figure 12.

INSERT FIGURE 12

Play organizing. Figure 13 shows the changes in level across conditions for play organizing. During baseline, play organizing behaviors were practically nonexistent across all participants. During intervention, however, significant increases were seen in Donny and Sheldon's (the second grade participants) data. Play organizing remained low for the kindergarten participants.

INSERT FIGURE 13

Turn taking and niceties. The other behaviors, turn taking and niceties, did not show significant changes across conditions, with the exception of niceties for Connor (0% baseline and 23% intervention). Further details can be seen in Table 13.

Fidelity

A 15-item fidelity checklist (Table 6) was completed during 14 intervention sessions across participants. Table 14 shows fidelity data across participants. Overall, 14 fidelity sessions were collected during 57 total intervention sessions (25% of intervention sessions), with a mean fidelity score of 89% and a range of 73-100%.

INSERT TABLE 14

Items most frequently scored “no” were #10 (Prompts focus child to initiate- 4 no’s), #13 (Conducts post-recess huddle- 4 no’s), #14 (Adds points to Party Chart correctly- 4 no’s), and #15 (Uses descriptive language/models appropriate behavior during non-play- 4 no’s). It is telling that two of the items frequently scored “no” were procedures that took place at the end of the session. These items were often missed because recess time was cut short, and implementers did not have time to implement these procedures. Another of the frequent “no” items, number 10 (Prompts focus child to initiate), indicates that implementers may have been more concerned with the participant responding to peer communication than initiating on their own. The final item on the fidelity checklist, #15 (Uses descriptive language/models appropriate behavior during non-play) is perhaps the most demanding of the checklist items, as it requires fluency in creative, activity-appropriate uses of the four key skills during each intervention session.

Items that received more than one score of “n/a” were #9 (Prompts focus child to respond- 3 n/a’s) and #10 (Prompts focus child to initiate- 2 n/a’s). A score of n/a was given when the behavior was viewed as unnecessary based on the participant or peers’ behaviors (e.g., the focus child was responding to peers’ initiations at an appropriate rate and thus did not need

prompting to do so). The only other item on which an n/a score was available was #8 (Prompts first through the peers), which received one score of n/a across all fidelity sessions. Two other scores of n/a were given during Andy's 17th intervention session. These n/a's were scored because the RA had to leave the session early, and wasn't able to observe whether the post-recess huddle or Party Chart procedures were carried out correctly.

Teacher Satisfaction Surveys

Following the completion of the PNRI, implementers and classroom teachers (n=5) were given a 12-item survey regarding their satisfaction with itemized components of the intervention. Of the three classroom teachers who participated in the intervention, two responded (one had moved away and did not respond to e-mails). All implementers provided feedback. Respondents rated their responses to the 12 items on a scale of 1-5; 1 being "strongly disagree", 2 being "disagree", 3 being "Somewhat", 4 being "Agree", and 5 being "Strongly Agree". Each item also included an "N/A" option. Table 15 displays survey items, mean responses, and ranges of responses to each item.

INSERT TABLE 15

The results of the Teacher Satisfaction Surveys are important regarding the social validity (feasibility, future use, etc.) of the intervention. Ratings were generally favorable, with the most frequent rating being 4, followed by 5, and then 3. Implementers tended to score more 3s and 5s than teachers, who tended to score 4s. All responses fell within the range of 3-5, meaning that there were no disagreements with any of the survey items. Items that received two or more ratings of 3 (the lowest ratings given) were items #4, #5, and #6, reflecting that the time of the recess groups was not always acceptable or easy to schedule, and that more peer time was

needed than acceptable sometimes. Items that received 2 or more ratings of 5 (strongly agree) were items #2, #8, #9, #10, and #12, reflecting that the research staff provided necessary assistance, that positive changes were noted in the network peers and other classmates, and that they would support peer network interventions in the future. At the end of the survey, teachers and implementers were asked for any further questions or comments. Table 16 presents a complete list of teacher comments and suggestions for improvements in their own words.

INSERT TABLE 16

The results of the PNRI show significant changes in level across total social communication of all participants and their peers during recess intervention sessions. Additionally, increases were seen across responses and initiations, and patterns were seen in the levels of specific communication behaviors across participants. Fidelity scores were high and teacher feedback was mostly positive. These results are further discussed in the following section.

Discussion

The purpose of this study was to evaluate the effects of the PNRI on the social communication behavior that occurred between children with autism and their classmates at recess. The study took place over eight months, from October to May. All four participants were currently involved in indoor structured social groups at school, but engaged in infrequent and/or inappropriate communication with peers during baseline recesses. This study sought to address three issues related to the literature available on peer mediated social skills interventions for children with ASD. The first issue was the paucity of research on peer mediated interventions that directly targeted recess, the most highly social school activity (Lang, Kuriakose, Lyons, Mulloy, Boutot, Britt, Caruthers, Ortega, O'Reilly, & Lancioni, 2011; Kasari et al., 2011).

Second, the available evidence suggests that social skills learned in school social groups by children with ASD do not always generalize to less structured social settings (Kasari, et al., 2011; Kamps, et al. 1997; Kamps, et al., 2002). Third, despite the importance of the role played by peer behavior in social communications with children with ASD, there are very little peer behavior data available in the peer mediation literature (Carter, Hughes, and Breen, 2001; Jackson & Campbell, 2009; Carter, Sisco, & Yun–Ching Chung, 2010; Koegel et al., 2012; Owen-Deschryver, Carr, Cale, & Blakely-Smith, 2008; Zanolli et al., 1996, Kamps et al., 1992).

Effects of Peer Networks Recess Intervention

The results showed that the PNRI (which consisted of classwide lessons, pre-recess huddles, implementer and peer prompting and feedback, whistle stops, post-recess huddles, and class parties) increased communication between young children with autism and their peers at recess. These findings are consistent with prior research showing increased social behaviors with implementation of peer mediation in recess settings (Harper, et al., 2008; Kasari, et al., 2011). Research has shown that interventions simultaneously targeting peer and participant behavior can produce significant and desirable behavior changes (Ingersoll, 2009; Pierce & Schreibman, 1997, Kamps, et al. 1997; Harper, et al., 2008; Owen-Deschryver, et al., 2008). The positive correlation between peer and participant communication levels seen in the results of the PNRI project presents further evidence that this is true.

For some of the participants, higher levels of prompting were necessary to increase social behaviors at recess. During baseline, all participants received very few prompts from adults or peers (see Table 12). Following intervention, prompt frequency from peers and adults increased for all participants except for Donny. Donny received no peer prompts throughout the project,

but did receive increased adult prompting during intervention. The fact that kindergarten participants needed more prompts speaks to the need for interventions that are responsive to differences between children. Child variables that could have influenced the need for additional prompts include verbal ability (i.e., Andy being less verbal, Connor more verbal but quieter around peers), and general play behavioral repertoires (or lack thereof). Results showed that the second grade participants' communication behavior increased without significant increases in peer prompts. These students and their peers were older and had superior language skills compared to kindergarten participants.

Overall, the use of PNRI procedures (social skills teaching, priming, prompting and reinforcement), were very successful in increasing participants' social behaviors and peer interactions. Findings support prior evidence for peer mediation interventions (Koegel et al., 2012) and the importance of peer training for social settings such as recess (Harper et al., 2008).

Peer Network Social Behaviors

The PNRI focused on four global social skills (Figure 4) that doubled as rules for playground conduct. These behaviors were selected for their simplicity and utility, and were based on PRT skills that had been successful in other social skill interventions (Harper et al., 2008; Koegel, et al., 1999; Pierce & Schriebman, 1997; Schriebman, et al., 1996). The four checklist behaviors were easy for the children to remember, especially considering that at four sessions a week and two whistle stops per session, group members recited and received feedback on the skills at least eight times a week. These rules lent themselves to the shaping of a large and generalized class of appropriate social communication skills. They are specific enough to use when replacing a multitude of inappropriate behavior or teaching new appropriate behaviors, and

universal enough to work within a variety of activities. The increases in participant initiations demonstrated the participants' responsiveness to the contingencies of the PNRI, and concur with prior research showing improved initiations with peer mediation (Oke & Schreibman, 1990; Reichow & Sabornie, 2009; Zanolli et al., 1996). The following is a set of examples in which each of the four key behaviors could be used to reinforce or redirect activity-specific behaviors.

Playing together and having fun. This rule's purpose was to create an establishing operation for the participants' sustained engagement, and for peers to persist in efforts to engage non-engaged participants. Under this rule, a child who elopes from social opportunities, for example, is under contingencies that can promote social engagement. This appeared to be the case for Andy, who was resistant to the intervention at first. During initial intervention sessions, for which there are no data because RAs were training the implementer, an extinction burst of escape-maintained behavior occurred. Behaviors included protesting, whining, and running away from peer volunteers. After a series of intervention sessions however, high levels of appropriate communication that maintained even during a non-intervention probe suggest that PNRI-shaped communication skills can come under the control of natural contingencies and replaced inappropriate behaviors at recess.

Complimenting and encouraging our friends. This rule's purpose was to create an establishing operation for complimentary behavior. This behavior could take verbal ("Nice jump!", "Good idea!") or physical form (high fives, pats on the back), and was included in the intervention to promote peer-delivered reinforcement and encouragement. Research has shown that peer-delivered affectionate interactions such as pats on the back and high fives can result in increased initiations and reciprocal play behavior for preschoolers with ASD (McEvoy,

Nordquist, Twardosz, Heckaman, Wehby, & Denny, 1988). *Complimenting and encouraging our friends* was included to promote similar results.

Talking about what we're doing and giving ideas. This rule had multiple functions in the PNRI. During baseline, all four participants largely avoided their peers. Because PNRI contingencies required sustained engagement during a variety of activities for reinforcement, and because the variety of activities required a variety of (often novel) play skills, it was important that participants received support when they lacked these skills. Lewis and Boucher (1995) found that 3 children with autism (ages 6-8) showed a lower ability to generate novel play activities with a toy car than neurotypical peers or peers with learning disabilities, but showed an equal ability to follow instructions when provided with ideas for play. *Talking about what we're doing and giving ideas* promoted the use of expository language by peers and participants during play sessions to support participants' attempts to engage in novel or challenging activities. Explanations of roles and rules were given and repeated by group members to any child who may have been behaving inappropriately or lacked specific play skills. This rule also encouraged participants to provide their own input into the rules of a given activity. With these skills in place, participants could inject their personal interests and preferences into peer-chosen activities to increase their reinforcing value (Koegel et al., 2012). During their intervention phases, Sheldon and Donny frequently incorporated favorite characters from video games and TV shows into activities that they may have otherwise avoided.

Using names and getting attention. This rule was designated as a Bonus Point on the whistle stop checklist. If participants were engaged throughout the play session, as was often the case even early in the intervention, the group got the point for free. The rule was developed as a

positively-stated rule for how to appropriately gain attention. Participant responses to peer initiations data (Figure 9) indicate that peers were successful in learning this skill. Some of the peers (especially in the kindergarten groups) tended to crowd and over-prompt the participant during early intervention sessions. With this rule in place, group members were under contingencies that promoted respect of the personal space of participants and created an abolishing operation for inappropriate attention-getting behaviors such as crowding, pulling, and grabbing. Additionally, implementers were able to promote appropriate replacement behaviors during whistle stops and huddles when inappropriate behaviors occurred. One specific case was that of the peer responsible for Andy's outlying baseline data point. The peer's behavior observed during this session was viewed as inappropriate. During the intervention phase, this peer became a regular peer volunteer. The intervention package's reliance on peers and its peer training component allowed the implementer to take advantage of her motivation for interaction with Andy and teach her appropriate ways to interact with him.

Specific Communication Behaviors

Results of the communication response type analysis led to some interesting findings. While commenting was by far the most common form of communication across all participants and requests showed similar effects across participants, non-verbal communication and play organizing were favored by some participants and not by others. In Andy's case, data indicated that he spent more time during both conditions engaging in non-verbal communication behavior than other participants. During intervention, however, his non-verbal communication behavior jumped from 13% to 43% of intervals. Considering that Andy had significant articulation impairments, high levels of nonverbal communication showed responsiveness to the intervention

and adaptability on his part. Figure 13, which shows mean percent of intervals including play organizing communication behavior shows that this type of behavior was favored strongly by the second grade participants, but rarely used by either of the kindergarteners. This is telling, due to the difference in the quality of play between kindergarten groups and the second graders' group. As previously mentioned, second grade recess activities were more imaginary and sophisticated in nature than kindergarten activities, and so play organizing was a pivotal skill for these participants. Sheldon, for example, was often observed complaining to teachers and staff that his classmates did not want to talk about his interests or play what he wanted to play. With the play organizing skills learned during intervention, Sheldon was able to inject those interests into the games of others' choosing with positive responses from his peers. These results speak to the flexibility of the PNRI to select and increase specific communication behavior types relevant to individual characteristics and immediate contexts

Generalization Effects of PNRI

During the design of the intervention, there was a choice to be made between a more structured intervention that included adult-chosen activities and a more loosely-structured intervention that sacrificed structure in order to promote generalization. It was already known that the social skills of the participants were not generalizing from social groups to the playground, so it was decided to avoid imposing activities in order to more effectively train for the flexibility required by the natural environment. This decision was based on one of Stokes and Baer's (1977) principles of generalization ("train loosely"). In addition, the decision was made in response to evidence in the literature for the effectiveness of intervening in natural

settings and training multiple peers (Pierce & Schreibman, 1997). By allowing children to choose the activities, training multiple exemplars was built in to the intervention.

Non-intervention probes were taken with three of the four participants during the intervention phase. Results of these observations showed that, following a series of intervention sessions, peer and participant behaviors remained above baseline levels in the absence of the intervention. These results suggest that the PNRI successfully programmed for generalization and maintenance (Stokes and Baer, 1977). This built-in flexibility not only allowed implementers to teach appropriate, activity-specific skills as classroom trends changed over time, but it also helped in addressing the different preferences of kindergarteners and second graders.

Consumer Satisfaction

Results of the teacher and implementer surveys (Table 14) provided important information regarding subjective perceptions of the intervention. All survey items were positively-stated comments about the project. It is pleasing to report that respondents at least somewhat agreed with all of these items. , The fact that there were no comments or suggestions regarding inappropriate behaviors suggests that the quality of behaviors seen during intervention was approved by school staff.

Most survey items received a score of 4 (Agree). Items that received ratings of 5 (Strongly Agree) were related to positive views of support provided by RAs, outcomes of the project, and support for the future implementation of the intervention. During the project, RAs were in constant contact with implementers and classroom teachers. Forms of support provided by RAs included working within classroom schedules and rules, training implementers on

intervention procedures, coaching and providing feedback, and discussing concerns specific to each group or participant. Occasionally, RAs also ran the intervention when implementers were not available. Whereas the primary dependent measures provided evidence for the effectiveness of the intervention, results of staff surveys provided evidence for its social validity. Both participating schools have continued the project in one form or another following the end of the study. A version of the PNRI was implemented with Andy and other students with ASD in a special education summer day camp, and Connor's special education teacher (who was not involved during the study) has used elements of the PNRI in her Lunch Buddies and Recess Buddies programs with Connor. Survey items that received more than one rating of 3 were items 4, 5, and 6. These items dealt with time requirements for teachers and peers. This is consistent with other researchers' statements that time constraints in classroom schedules are an obstacle for those attempting to intervene on social behaviors (Harper, et al., 2008; Lang, et al., 2011). In spite of efforts to coordinate with staff on scheduling, it appears that time requirements were still a challenge. According to staff comments, some implementers felt that certain peers grew tired of the intervention over time. This may be reflective of a weakness in implementer training, as voluntarism was specifically and purposefully included in the intervention procedures. The voluntary nature of the intervention was intended to encourage the development of a large, rotating pool of interested and motivated peers. Peers should be viewed as an instructional asset on the playground or in any social context (Lang, et al., 2011), and their motivation to participate should be considered in the design of a PMI. With the exception of one of Connor's intervention observations (in which the class had lost recess privileges and a small group of regular peer volunteers was selected by the implementer so that a session could take place), all peers' participation was voluntary during observations. However, due to RA availability, observations

did not occur during every PNRI session. The PNRI required a minimum of four sessions per week. The two participating schools were more than 100 miles apart, and RAs were only on either site one to three times per week typically. During the intervention, the author was approached a few times by peers who wanted to decline participation. The author's response was always permissive but hopeful that they would return for later sessions. It is possible that there were peers who were not forthcoming about their desire to volunteer. This could have been remedied by a more thorough search for volunteers before play sessions, instead of the general announcement request for peers just prior to the pre-recess huddle. Classroom peers who declined participation of any kind still attended class parties, and peers from other classrooms were welcome to volunteer at recess and come to class parties with teacher permission. In light of all of this, the feedback regarding peer fatigue and desire for the inclusion of a greater variety of peers should be considered by researchers in the future.

Limitations

There are a number of limitations to this study. One limitation was the small number of participants. The small n size limited the ability to generalize findings to large groups of children with ASD. The replication of effects across three non-concurrent interventions and four participants does not sufficiently address the question of how this intervention might affect the behavior of a larger population of children. Another limitation is the fact that two of the participants, Donny and Sheldon, were in the same classroom. This presented a challenge in executing a non-concurrent multiple baseline across participants design. Both participants met the inclusion criteria, however, and were accessible to PNRI staff. It is unfortunate that intervention was begun before Donny's baseline showed stability, but it was decided that

beginning the intervention at that time would allow intervention phase data to show an increase in level while allowing time to introduce the intervention for Connor before the end of the school year. A further limitation of the study was the minimal number of generalization probes and the lack of non-intervention probes during Connor's intervention phase. Because Connor's intervention was begun so close to the end of the school year, it was decided to forego non-intervention generalization data in exchange for more primary intervention data. It would have been interesting and useful to determine whether communication levels maintained during non-intervention probes for Connor and during multiple probes over a longer period of time for all participants, especially following an extended period of time in the absence of intervention sessions.

The presence of RAs on the playground during non-intervention probes was a confounding variable. It is possible that the presence of RAs, who otherwise had been present only during intervention sessions during this phase of the study, had an effect on the behavior of the children. In order to control for this limitation as much as possible, it was explained to the children before each non-intervention probe that they would not be earning points toward their class party during these times, and implementers were asked not to use intervention techniques learned during training.

Variability, noted across all participant and peer data during intervention phases, is also a limitation of the study. Variation in activities across sessions created situations in which levels of appropriate engagement were correlated with varying levels of appropriate, codeable social communication. In other words, some activities required more communication than others. Motor activities such as running across the playground or going across the monkey bars resulted

in sustained periods of non-communication during which participants were still consistently and appropriately engaged with peers. The fact that the data reflects only one aspect of appropriate engagement, social communication, is a limitation of the study as well.

During two participants' (Andy's and Donny's) baseline conditions, there were outlying data points that warrant further discussion. During Andy's 11th baseline session, peer initiations were observed during 90% of intervals, which far exceeds the peer initiation baseline mean of 22.7%. During this session, a single female peer spent most of her recess chasing Andy, calling his name, and tickling him. Data show that Andy responded to his peers during 20% of intervals. Closer inspection of these data revealed that Andy did not initiate during this session. Therefore, all of his communication behavior was in response to this peer. Notes from the session showed that requests such as "Stop", "Want to play alone", and "Don't" made up the majority of these responses. Aside from this outlier, baseline measures were consistently low. After three low-communication baseline data points following the outlier, it was decided that baseline data were sufficiently stable, and the intervention was introduced. Another baseline outlier occurred later with Donny during his fifth observation. Donny's total communicative acts for this session were 100% of intervals, and peer data were 90%. Just as in Andy's baseline outlier, the peer data represented the behavior of a single peer. Interestingly, in this case that peer was Sheldon. During this observation (according to notes from the session), Donny and Sheldon spent their recess at the edge of the playground and away from other peers, engaged in an argument over the video game Angry Birds. Again, in spite of high levels of social engagement, the interactions were inappropriate and diverged greatly from baseline means.

A final limitation was the selection of only a few dependent measures (total communication, initiations, and responses). The NOLDUS software allowed for frequency data that distinguished between who exhibited social behavior, whether each behavior was an initiation or response, and a minimum of seven response type modifiers. However, initial attempts at data collection on the playground resulted in low interobserver reliability. Children moved frequently and it was sometimes difficult to hear what was being said during crowded and noisy recesses. This limitation was addressed by printing raw data files post-data collection and recoding the data to reflect the percent of 30-s intervals in which communicative acts were observed. This method, though less intimate, resulted in satisfactory IOA scores without distorting the basic levels and trends in the data. Some low ranges of reliability were still noted, but these tended to be during sessions with low occurrences of behaviors.

Conclusions and Implications for Future Research

Further research is needed to develop a technology of socially valid, feasible, and effective peer-mediated social skills interventions that target the recess setting (Harper, et al., 2008; Lang, et al., 2011). It would be interesting to collect longitudinal follow-up data on participants. Research questions would include whether skills learned during the intervention maintained and/or generalized to new classrooms and peers encountered by participants in the years following. It would also be interesting to examine whether children who had participated as peer mediators maintained their skills, and whether they generalized them to other classmates with ASD or social impairments.

The PNRI was shown to be effective in increasing reciprocal communication between children with autism and their peers at recess. However, it was an intervention package

comprised of several components working together. A component analysis might reveal that certain components of the intervention were unnecessary, or that different combinations result in different effects. Such a component analysis would be useful in streamlining future PMI recess interventions.

It may be of note that there were elements of the PNRI that were programmed originally, but dropped after just a few sessions due to feasibility issues and child responses. One such element was the use of textual prompts. Peer volunteers were asked to carry index cards with positive statements such as “Yes”, “Okay”, and “Awesome” written on them, and use them to prompt social communication from participants. During these initial sessions, peers were resistant to using the text cues. They would drop them on the playground and leave them behind, and often refuse to take them during pre-recess huddles. After encountering this resistance, it was decided that although text cues had been found to be useful in the literature (Thiemann & Goldstein, 2001; Theimann & Goldstein, 2004) and even in Peer Networks social groups with Andy and Connor, they were not a feasible intervention component for the recess setting. The field would benefit from the development of feasible visual cues for use in recess interventions. Another initial element of the PNRI that was discarded in the early intervention phase was the designation of “captain” for the peer volunteers. The captain was to be in charge of making sure that the participant was engaged and prompting other peers to prompt the participant. After just a few sessions with Andy and the second grade participants, it became apparent that designating captains was causing jealousy and arguments among the peers, and not making a positive impact on the behavior of the participant.

The PNRI was based on the teaching and positive reinforcement of appropriate social skills. As previously mentioned, adult-child interaction during baseline consisted mostly of reprimands for inappropriate behavior. Objective measures of the quality of child-directed communication from staff, and its effects on child behavior during recess before and after PMI training, would benefit the field.

Finally, future research should focus on developing operational definitions that more accurately reflect the true value of social engagement at recess, and utilize interval or momentary time sampling data collection procedures. Such measures would control for issues encountered in this study that resulted in variability of the data.

In conclusion, as the technology of peer-mediated social skills intervention continues to grow and be disseminated, the lives of countless school children (both with and without ASD) may be positively affected, and its use may be further integrated into the fabric of mainstream education policy and practice. The present study provided strong evidence that a multiple component intervention including direct instruction, priming, prompting, peer-mediation, contingent reinforcement, and token economies can improve the social communication behaviors that take place between children with autism and their peers at recess. The use of such interventions during recess is paramount in consideration of the relative amount of opportunity for social interaction that recess provides and the sophistication of skills that it requires (Harper, et al., 2008). This study adds much needed evidence to the literature on peer-mediated social skills interventions at recess. Clearly the characteristics of ASD can have profound and lifelong effects (Frea, 1995; Ingersoll, et al., 2001; McClelland, et al., 2000). Early intervention in settings with peers that result in improvements in social behaviors may impact those life

trajectories from one of isolation and loneliness to one of participation and friendship. More research in the area, including longitudinal and group design studies, are needed to contribute to developing a technology of practical interventions that can be applied in school settings.

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Table 1

Participants' Assessment Scores

Participant	date of assessment	Peabody Picture Vocabulary Test total standard score	SRS total T-Score	CARS raw score
Andy	Spring 2012	85-average	60-moderate	38-severe
Sheldon	Spring 2011	89-average	57-normal	34-mild to moderate
Donny	Spring 2011	92-average	59-normal	30-mild to moderate
Connor	Spring 2012	75-moderately low	53-normal	39-severe

Note. Data reflect most recent available scores.

*PPVT 70 to 84 moderately low; 85-114 average.

* SRS 59 or less normal; 60-75 moderate.

* CARS 15-30 normal; 30-37 mild to moderate; 37+ severe.

Table 2

Operational Definitions of NOLDUS Social Behaviors

Dependent measure	Definition
Child Designation	
F (focus child)	A communicative act emitted by the participant
P (peer)	A communicative act emitted by a peer
Response Type	
I (initiation)	A communicative act that begins a new topic of conversation or is not contextually related to ongoing communication between or action(s) of group members.
R (response)	A communicative act that refers to or is on topic with recent (within 10 sec) initiations or responses of other group members.
Social Behavior Definitions	
COM (Comment)	A communicative act that refers to ongoing events, items, or actions, but is not a compliment. Examples: "There's the slide," "This is fun," "You slid down the pole".
RQ (Request)	A communicative act whose function is to elicit information, action, or reciprocal communication from group member(s) (i.e., greetings). Examples: "Hi, Charlie", "Follow me", "Pass the baton", "Where's Andy?".
PLO (Play organizer)	A communicative act that functions to set up a game or activity or labels a general rule of the activity. Examples: "The jungle gym is base", "The first one to the slide gets to be Captain", "We're going to play Power Rangers", "You guys are on the red team", "We're pirates".
TT (Turn taking)	A communicative act that contains the word "turn" or refers to turns by number or ordinal. Examples: "It's your/my turn", "Whose turn is it?", "I'll go next", "You're first", "Andy is third".
NIC (Nicety)	A comment that is complimentary. Niceties also include terms synonymous with "good manners" such as "Thank you" and "You're welcome". Examples: "Good idea", "Thanks", "Nice jump", "Well done".
HLP (Help)	A communicative act that elicits help from a communication partner or offers help. Examples: "Help me", "Need a hand?", "Can we help?".
NonV (Non-verbal)	A non-verbal communicative act. Examples: waving, looking at a peer when requested to do so, shoulder-tapping, winking, gesturing toward an object or person.

Table 3

Reliability Totals and Percentages

Participant/Phase and % of sessions with IOA	mean/ range	Part- icipant Initiations	Par- ticipant Responses	total Par- ticipant acts	Peer Initi- ations	Peer Re- sponses	Total Peer Acts	Adult prompts
Andy baseline 7%	mean	100	100	100	95	100	95	100
	range	-	-	-	-	-	-	-
Andy intervention 35%	mean	83	80	76	84	75	90	96
	range	75-95	65-95	65-95	65-95	15-95	80-95	85-100
Andy overall 35%	mean	85	83	79	86	78	91	97
	range	75-100	65-100	65-100	65-95	15-100	80-95	85-100
Sheldon baseline 29%	mean	88	85	90	95	87.5	92.5	100
	range	85-95	75-95	90-90	95-95	85-90	95-90	100-100
Sheldon interv. 23%	mean	81	70	86	84	69	90	95
	range	75-86	57-85	81-95	67-95	60-81	81-100	85-100
Sheldon overall 25%	mean	83	76	87	88	77	91	97
	range	75-95	57-95	65-100	67-95	60-90	81-100	85-100
Donny baseline 14%	mean	85	85	80	70	80	70	100
	range	85-85	85-85	80-80	70-70	80-80	70-70	100-100
Donny intervention 36%	mean	87	72	92	67	84	90	88
	range	80-94	61-85	85-100	55-75	72-100	80-100	83-100
Donny overall 29%	mean	87	74	90	67	83	86	91
	range	80-94	61-85	80-100	55-75	72-100	70-100	83-100
Connor baseline 62%	mean	95	98	96	96	96	98	100
	range	86-100	90-100	86-100	89-100	89-100	89-100	100-100
Connor interv. 10%	mean	35	71	88	47	88	71	76
	range	-	-	-	-	-	-	-
Connor overall 39%	mean	88	95	95	91	95	95	97
	range	36-100	71-100	86-100	47-100	88-100	71-100	76-100
All baseline 31%	mean	93	95	94	94	94	94	100
	range	85-100	75-100	80-100	70-100	85-100	70-100	100-100
All intervention 28%	mean	81	76	83	78	77	89	93
	range	35-95	57-95	65-100	47-95	15-100	71-100	76-100
All overall 29%	mean	86	84	88	84	84	91	96
	range	35-100	57-100	65-100	47-100	15-100	70-100	76-100

Table 4

Interobserver Agreement Data for Specific Social Behavior Reliability

	Comments	Requests	Turn Taking	Nonverbal	Niceties	Play Organizing
baseline	88%	100%	100%	100%	100%	100%
intervention	99%	100%	100%	88%	100%	100%

Table 5

Momentary Time Sampling Operational Definitions

Behavior	Definition
Engaged	A score of "E" on the Momentary Time Sampling Data Sheet indicates that, at the end of the 1-min interval, the participant's behavior met all of the following criteria:
	a) One or more peer volunteer(s) are appropriately engaged in a mutual activity within proximity of the participant.
	b) The participant is responding to the behavior of his peer(s) with either imitation, approximation of imitation, or reciprocation. Examples of reciprocation include but are not limited to responding to a question with an on-topic response, following an instruction, or responding appropriately to a request. Specific examples include catching a ball that is thrown, following the leader of the activity by chasing/tagging, etc., listening to rules of the activity, requesting that peers play a game, etc.
Attempt	A score of "A" on the Momentary Time Sampling Data sheet indicates that at the end of the 1-min interval, the participant's behavior does not meet the definition of "Engaged", but that peers are within proximity and oriented toward the participant using one or a combination of the following attention-getting behaviors:
	a) Using the participant's name (or another appropriate initiation) with activity-specific appropriate voice volume.
	b) Using one or more fingers of a single hand to tap the participant's shoulder, back, or arm with appropriate intensity.
	c) using the flat palm of a single hand to lightly pat the participant's arm, shoulder, or back.
	d) tugging lightly on a single hand of the participant.
Not Engaged	The behavior of the participant and his peers does not meet either of the above definitions.

Table 6

Fidelity Checklist

1. Gathers peers and participant(s)	yes	no
Reviews 4 key skills:		
2. Playing together and having fun	yes	no
3. Complimenting and encouraging our friends	yes	no
4. Talking about what we're doing and giving ideas	yes	no
5. Using names and getting attention	yes	no
6. Observes group	yes	no
7. Uses Momentary Time Sampling Sheet correctly	yes	no
If participants are not engaged:		
8. Prompts first through the peers	yes	no n/a
9. Prompts focus child to respond	yes	no n/a
10. Prompts focus child to initiate	yes	no n/a
11. Conducts whistle stop #1 correctly	yes	no
12. Conducts whistle stop #2 correctly	yes	no
13. Conducts post-recess huddle	yes	no
14. Adds points to Party Chart correctly	yes	no
15. Uses descriptive language/models appropriate behavior during non-play	yes	no

Table 8

Relationships Between Whistle Stop Behaviors and Pivotal Response Techniques

<div> <div>Pivotal Response Techniques →</div> <div>Whistle Stop Behaviors ↓</div> </div>	Gain Attention	Reinforce Attempts	Encourage Conversation	Extend Conversation	Narrate Play
Playing Together and Having Fun	X		X	X	
Complimenting and Encouraging Our Friends		X	X	X	
Talking About What We're Doing and Giving Ideas	X		X	X	X
Using Names and Getting Attention	X				

Table 9

Means, Ranges, and Standard Deviations of Total Social Communication for All Participants and Peers Across Conditions

		Baseline			Intervention		
		Mean	Range	Std. Deviation	Mean	Range	Std. Deviation
Andy	Andy	9%	0-35%	10	77%	40-100%	16
	peer	27%	0-90%	23	90%	70-100%	10
Sheldon	Sheldon	26%	0-55%	14	81%	60-95%	14
	peer	27%	0-60%	21	81%	52-100%	14
Donny	Donny	35%	15-100%	33	85%	70-100%	9
	peer	34%	10-90%	29	80%	60-90%	10
Connor	Connor	15%	5-35%	10	77%	40-100%	16
	peer	13%	5-35%	10	67%	48-100%	14

Table 10

Effects of PNRI on Initiations

	Baseline Initiations Mean	Baseline Initiations Range	Intervention Initiations Mean	Intervention Initiations Range
Andy	3%	0-15%	34%	10-75%
Andy's peers	20%	0-90%	80%	35-95%
Sheldon	17%	0-37%	46%	25-86%
Sheldon's Peers	19%	0-45%	69%	48-81%
Donny	22%	5-75%	58%	40-90%
Donny's Peers	23%	10-35%	61%	35-80%
Connor	11%	0-25%	56%	30-80%
Connor's Peers	10%	0-30%	54%	35-100%

Table 11

Effects of PNRI on Responses

	Baseline Responses Mean	Baseline Responses Range	Intervention Responses Mean	Intervention Responses Range
Andy	5%	0-25%	63%	20-90%
Andy's peers	2%	0-10%	42%	15-81%
Sheldon	12%	0-30%	62%	43-95%
Sheldon's Peers	12%	0-40%	45%	20-86%
Donny	24%	5-75%	57%	30-70%
Donny's Peers	18%	0-80%	48%	10-75%
Connor	5%	0-15%	47%	25-78%
Connor's Peers	4%	0-20%	35%	5-55%

Table 12

Levels of Adult and Peer Prompts Across Conditions

	Andy		Sheldon		Donny		Connor	
	BL	IV	BL	IV	BL	IV	BL	IV
Adult Prompts								
total frequency	2	64	0	20	0	34	0	93
(total sessions)	(14)	(13)	(7)	(13)	(6)	(11)	(13)	(10)
mean per session	0.1	4.9	0	1.5	0	2.8	0	9.3
range	0-1	0-10	0-0	0-7	0-0	0-6	0-0	1-19
Peer Prompts								
total frequency	1	98	0	3	0	0	3	8
(total sessions)	(14)	(23)	(7)	(13)	(6)	(11)	(13)	(10)
mean per session	0.1	4.3	0	0.2	0	0	0.2	0.8
range	0-20	0-20	0-0	0-2	0-0	0-0	0-3	0-3

Table 13

Means and Ranges of Specific Social Behaviors Across Conditions and Participants

		Comments	Requests	Turn Taking	Nonverbal	Niceties	Play Organizing
Andy baseline	mean	2%	5%	0%	13%	0%	0%
	range	0-5	0-10	0-0	5-25	0-0	0-0
Andy intervention	mean	50%	22%	1%	43%	9%	1%
	range	30-85	15-40	0-5	35-50	0-30	0-5
Sheldon baseline	mean	20%	7%	0%	3%	0%	0%
	range	10-40	0-10	0-0	0-5	0-0	0-0
Sheldon intervention	mean	54%'	12%	0%	21%	8%	19%
	range	35-90	10-15	0-0	5-35	0-15	0-45
Donny baseline	mean	47%	5%	5%	3%	0%	3%
	range	10-95	0-10	0-15	0-5	0-0	0-10
Donny intervention	mean	61%	21%	1%	12%	3%	14%
	range	35-85	0-5	0-5	0-30	0-10	5-30
Connor baseline	mean	15%	7%	3%	0%	0%	0%
	range	5-30	5-10	0-10	0-0	0-0	0-0
Connor intervention	mean	40%	23%	4%	9%	23%	2%
	range	25-50	5-45	0-10	0-25	10-30	0-5

Table 14

Fidelity Ratings During Peer Networks Recess Intervention

	Andy	Sheldon	Donny	Connor	Overall
Number of Intervention Sessions	23	13	11	10	57
Number of Fidelity Sessions	5	4	3	2	14
Percentage of IV Sessions with Fidelity Measures	22%	31%	27%	20%	25%
Mean Fidelity	86%	86%	96%	90%	89%
Fidelity Range	73-100%	79-100%	93-100%	87-93%	73-100%

Table 15

Survey Items with Response Means and Ranges

Survey Item	Response Means	Range of Responses
1. I understood the project expectations and time commitments of the recess project.	4.2	4-5
2. Project staff provided necessary assistance for the recess group throughout the project.	4.2	4-5
3. I felt comfortable giving feedback to the project staff, and talking with the staff about making changes (i.e., in schedules, peer involvement, activities) during the project.	4.2	4-5
4. The length and frequency of the recess groups (i.e., 10-15 min, 4x weekly) was acceptable.	3.2	3-5
5. The times for the social groups were easy to plan in the teachers' and children's daily schedule.	3.6	3-5
6. The time required for the peers without disabilities to participate was acceptable.	3.8	3-4
7. The strategies for teaching the children with autism to talk and interact with their peers were easy to learn and effective.	4	4-5
8. I observed positive changes in social interactions between the children with autism and their group volunteer peers.	4	4-5
9. I observed positive changes in social interactions between the children with autism and other non-volunteer students who were not directly involved in the recess groups.	3.8	3-5
10. I feel the social group intervention was beneficial to the peers without disabilities.	4	3-5
11. The students involved (both children with autism and their peers) seemed to enjoy and look forward to participating in the groups.	3.8	3-5
12. I would continue to support or use this peer-mediated social communication intervention in the future.	4	4-5

Table 16

Teacher Feedback: Comments and Suggestions for Improvement

Teacher Feedback - Comments
I liked prompting the peers instead of my students with autism. I wish I would have had more time to talk to the peers without the student with autism around. This is something I would do more of I the future. I didn't like that we had only a few peers that were good at giving prompts (I know that was something we could not control). It seemed like when we kept using the same peers for the group they would get bored. I like that is didn't take long to implement the therapy, but, as always, it was difficulty (sp) to schedule because of recess being early/late. Overall, I loved the concept and will use it in the future!
It was difficult to do the interaction 4 times a week, sometimes it conflicted with other things. The positive thing is that I think this strategy can work in the classroom with games they play. After a while the students got tired of doing the project.
I loved seeing the positive changes in how all the children interacted with the students with autism.
Teacher Feedback - Suggestions for Improvement
I would have more peers and rotate them so no one student has to be part of the group every time.
I would talk to the peers more before starting (I know the Juniper staff did most of this). Find an easier way to corral kids. Maybe take the group out to recess early or something like we did once.
Maybe mixing up the peer groups periodically to allow more students to participate in the project.
I think if you did some classroom activities and involve the whole class it might help with the recess project.
Maybe try and work 3 days in recess and once or twice in the classroom.
Have all the teachers in that grade involved so it is easier to switch groups of kids.
More training for staff would be beneficial.
Times often exceeded 10-15 minutes which is fine.
An overview to the school staff would be beneficial.

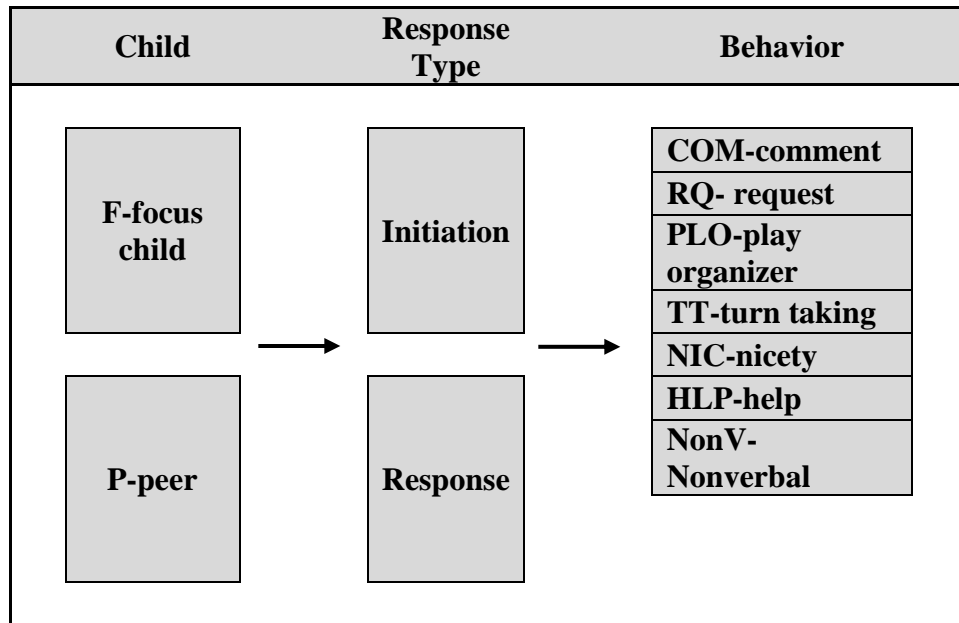


Figure 1. NOLDUS dependent measures and their modifiers

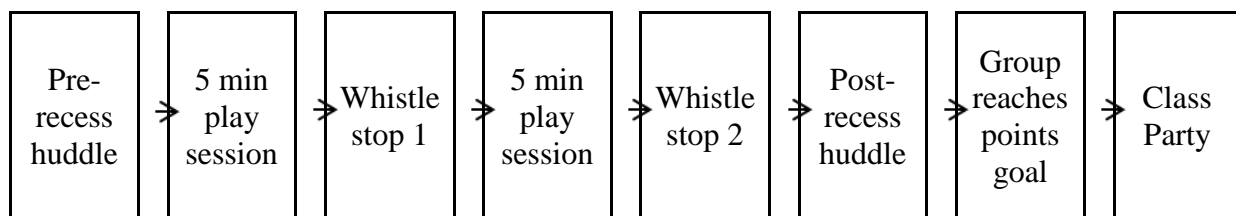


Figure 2. Recess intervention timeline. Observation and prompting took place during Play Sessions at recess. Scripts and visual aids such as data sheets were used during the other elements of the timeline.

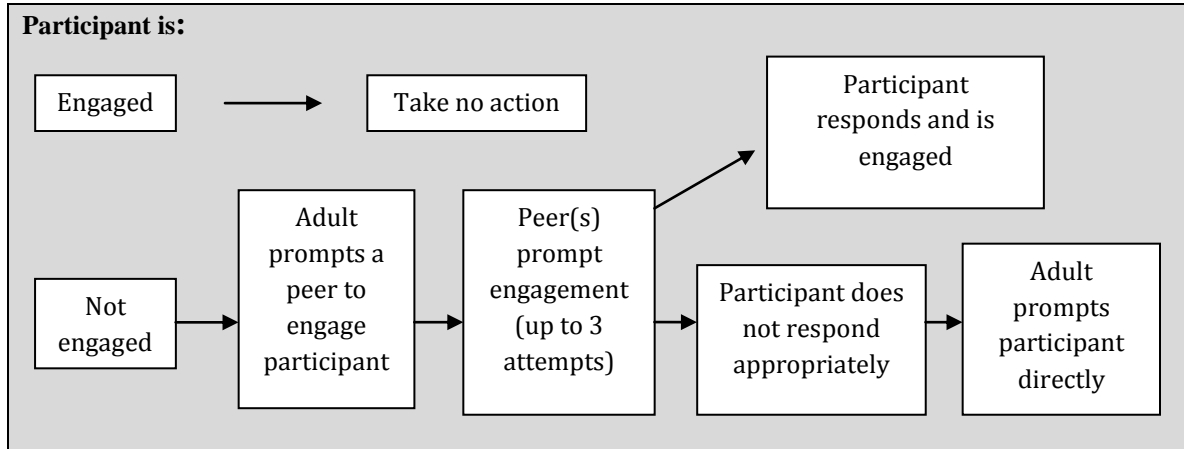


Figure 3. A flowchart depicting decision-making process used by a trained PNRI implementer regarding use of prompts and the levels thereof.

Are we...

☐ **Playing together and having fun?**

☐ **Complementing and encouraging our friends?**

☐ **Talking about what we're doing and giving ideas?**

 **Using names and getting attention?**

teacher initials: _____ date: _____

Figure 4. A single whistle stop section of whistle stop checklist. Whistle stop checklist data sheets contained nine of these sections.

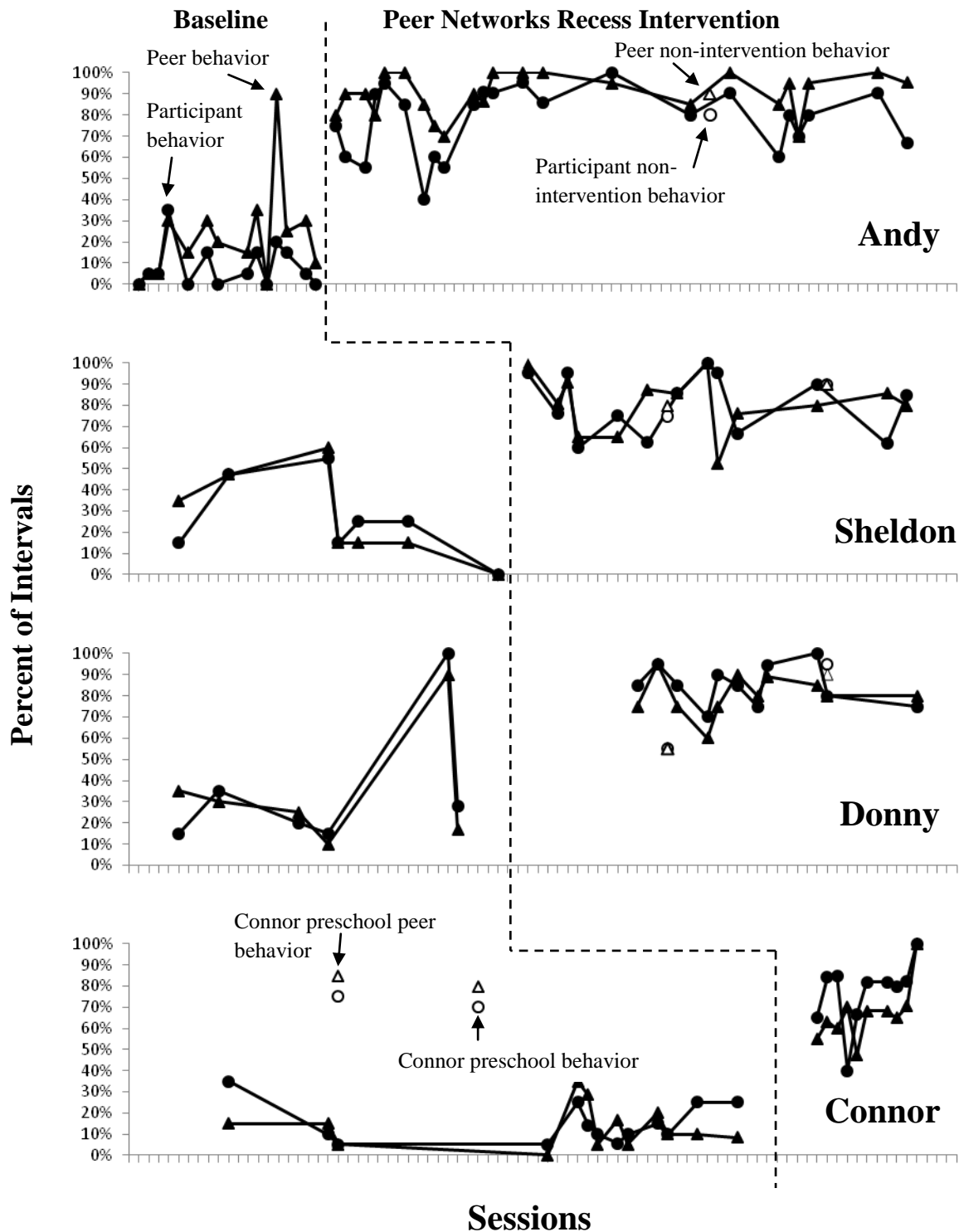


Figure 5. Percent of intervals including peer and focus child social communication behavior. Circles = focus child behavior. Triangles = peer behavior. Open markers= non-intervention probes for top 3 tiers and preschool probes for 4th tier.

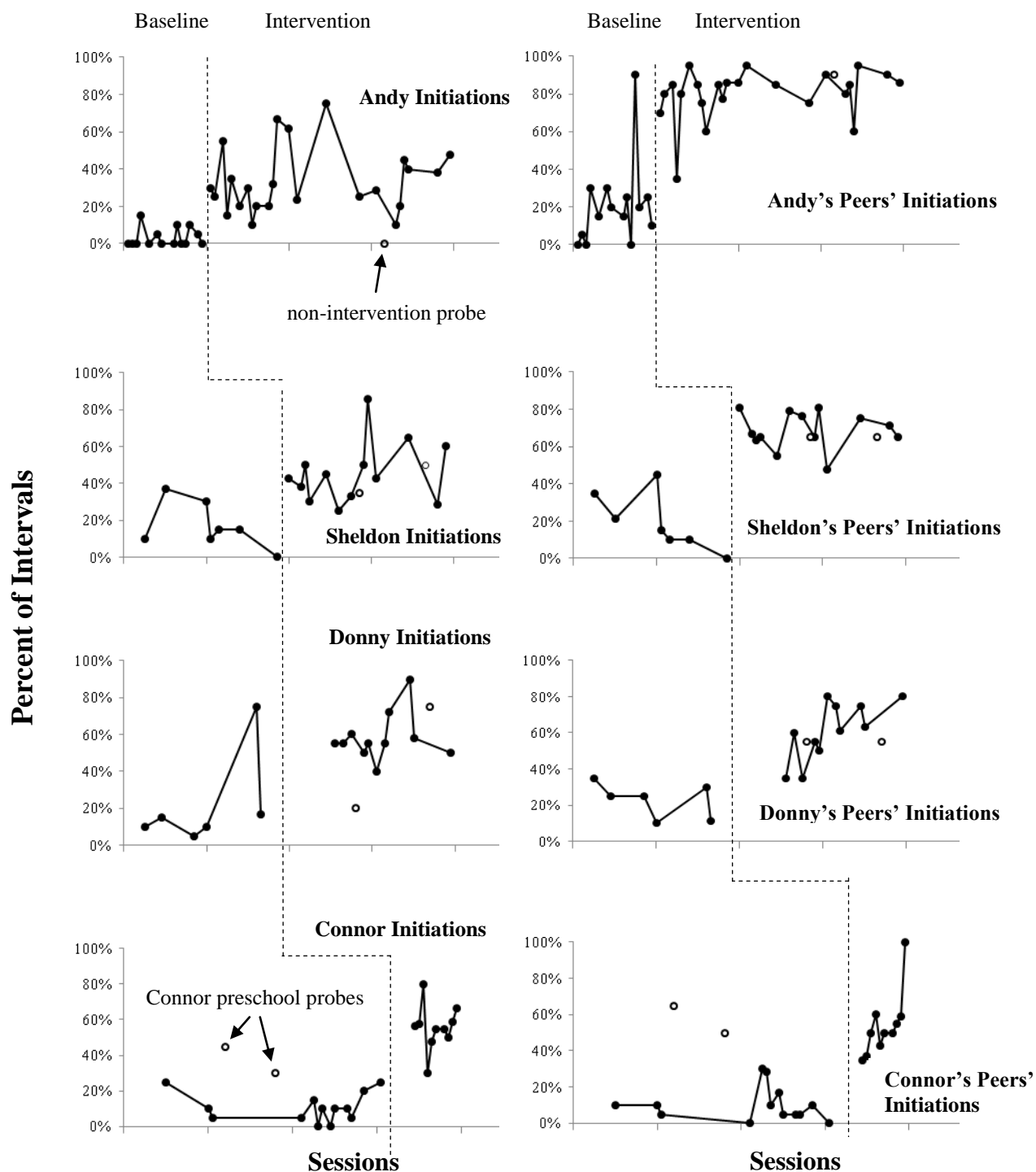


Figure 6. A side-by-side comparison of participant and peer percent-of-interval measures including initiations across conditions and participants. Black circles represent baseline and intervention session observation data. White circles represent non-intervention probe data for Andy, Sheldon, and Donny, and Preschool baseline probes for Connor.

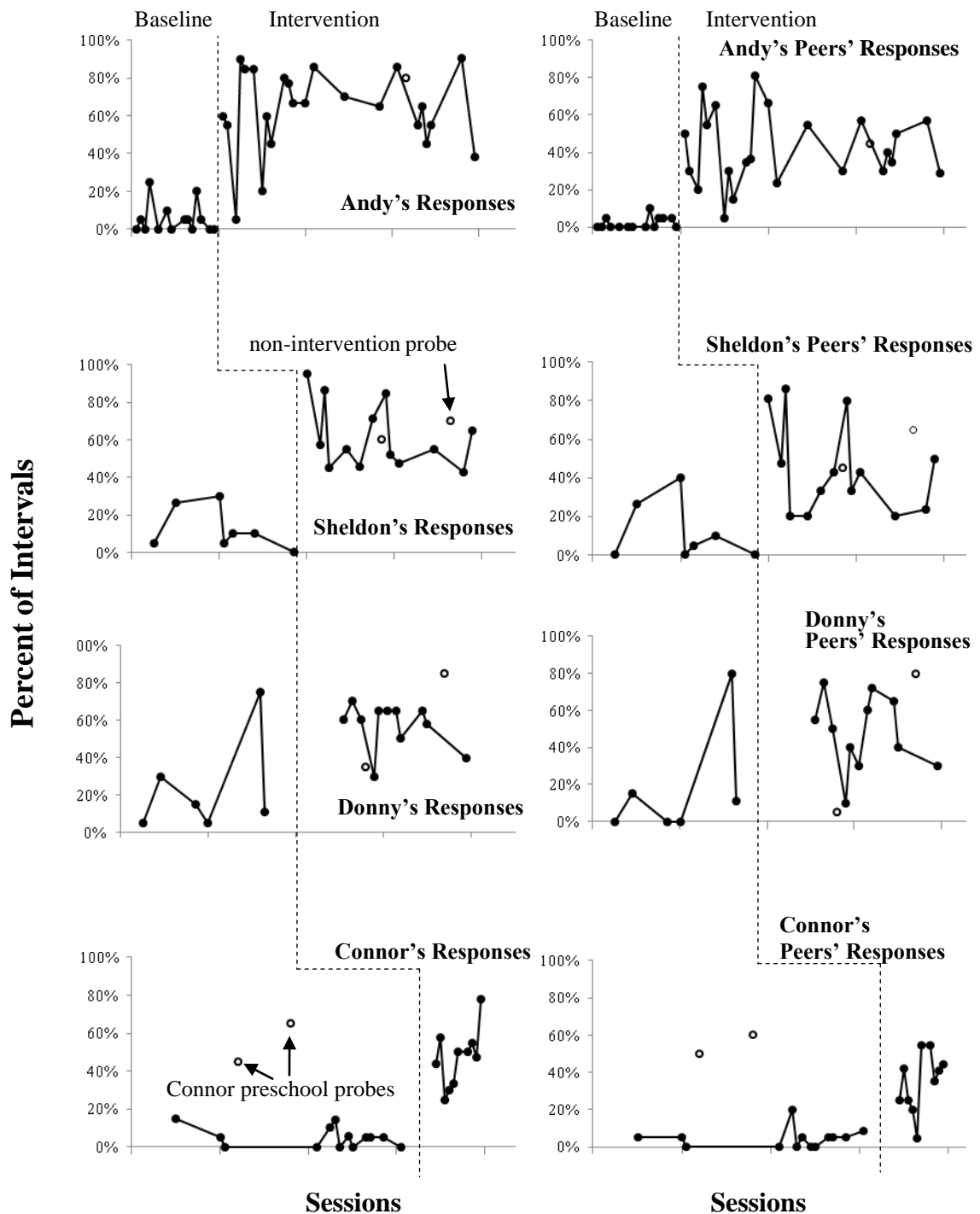


Figure 7. A side-by-side comparison of the participant and peer changes in percent of interval measures including responses across conditions and participants. Black circles represent baseline and intervention session observation data. White circles represent non-intervention probe data for Andy, Sheldon, and Donny, and Preschool baseline probes for Connor.

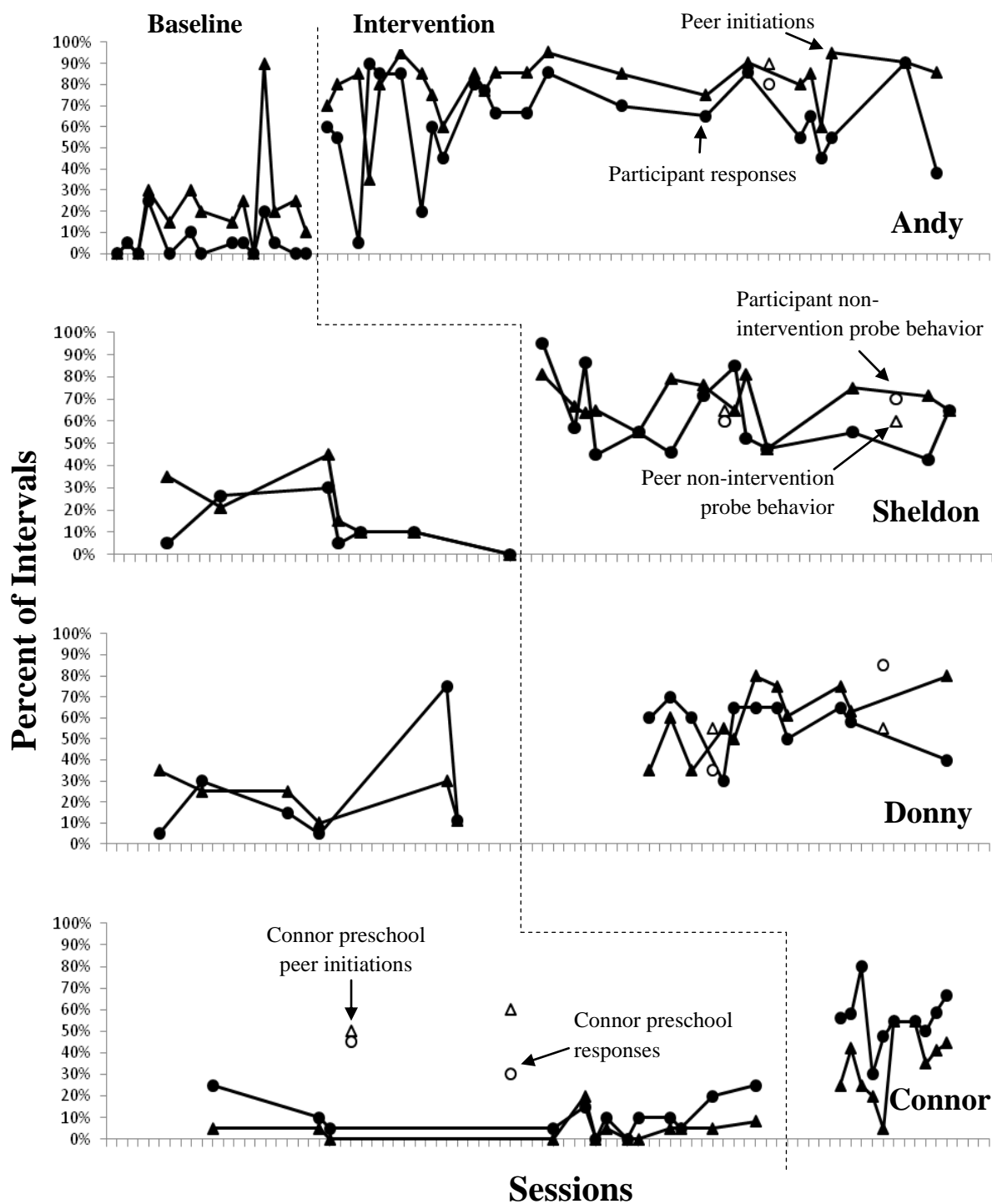


Figure 8. Percent of intervals in which the participant responded to peers and percent of intervals in which peer(s) initiated to participants during observations.

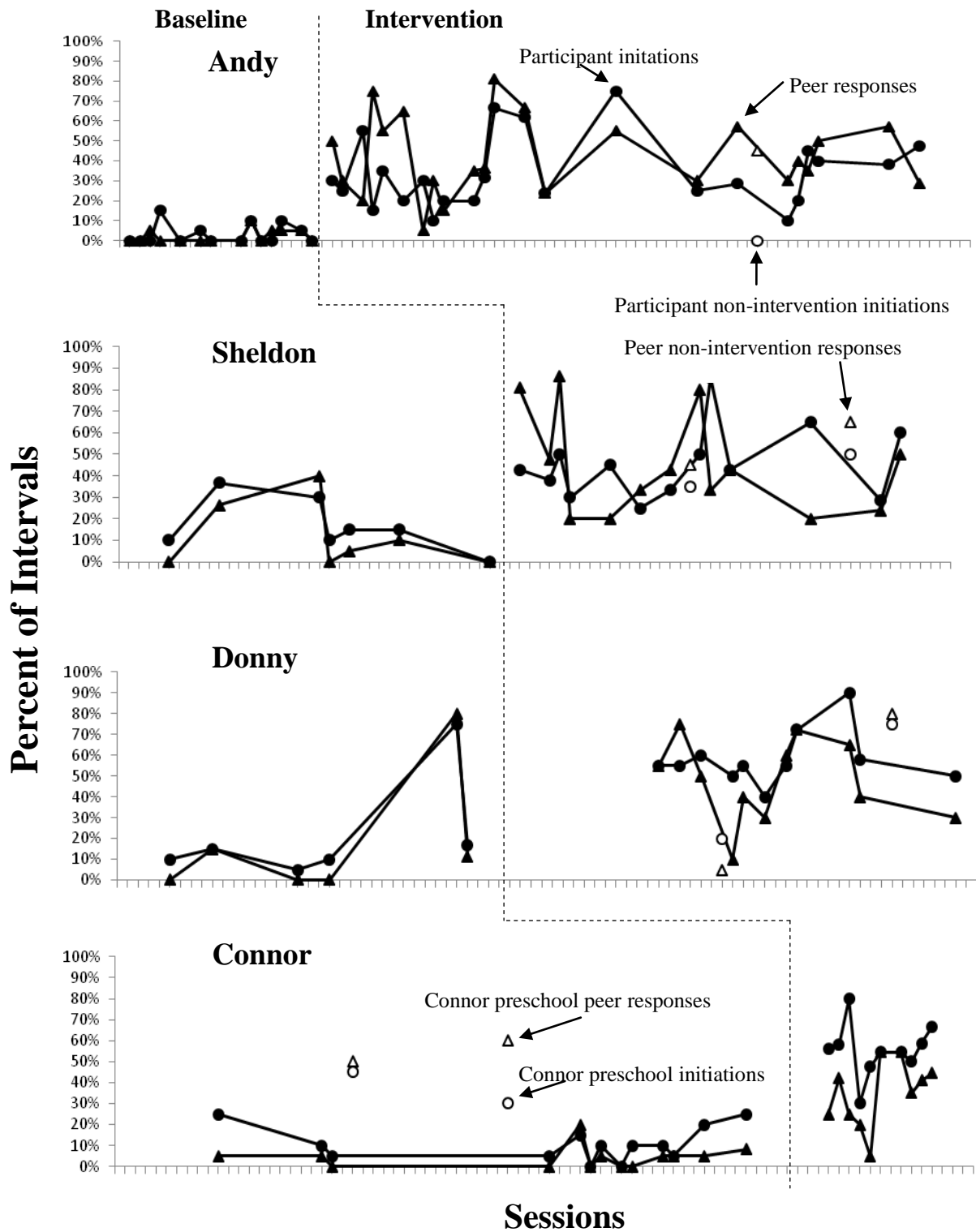


Figure 9. Percent of intervals in which peers responded to participants and percent of intervals in which participants initiated to peers during observations.

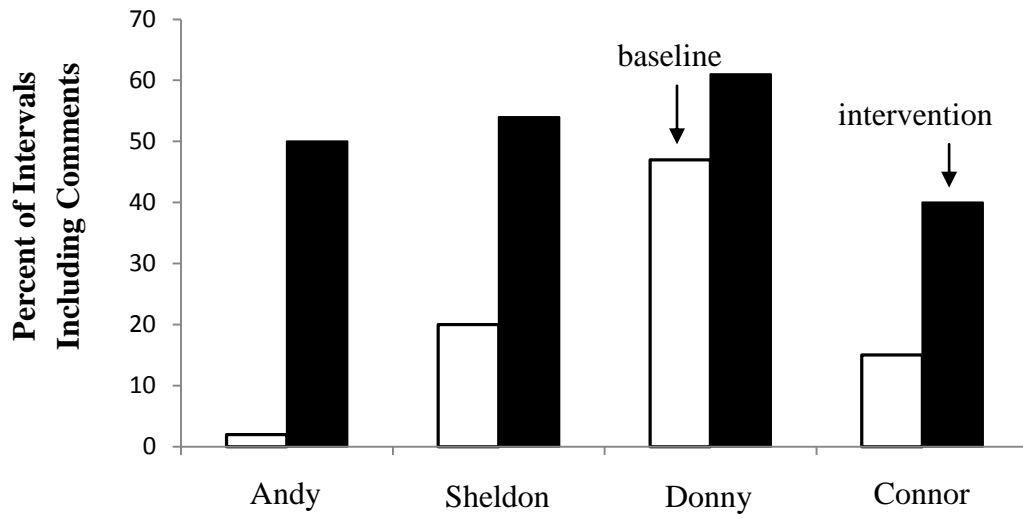


Figure 10. Mean percent of intervals during sampled sessions including participant comments across conditions.

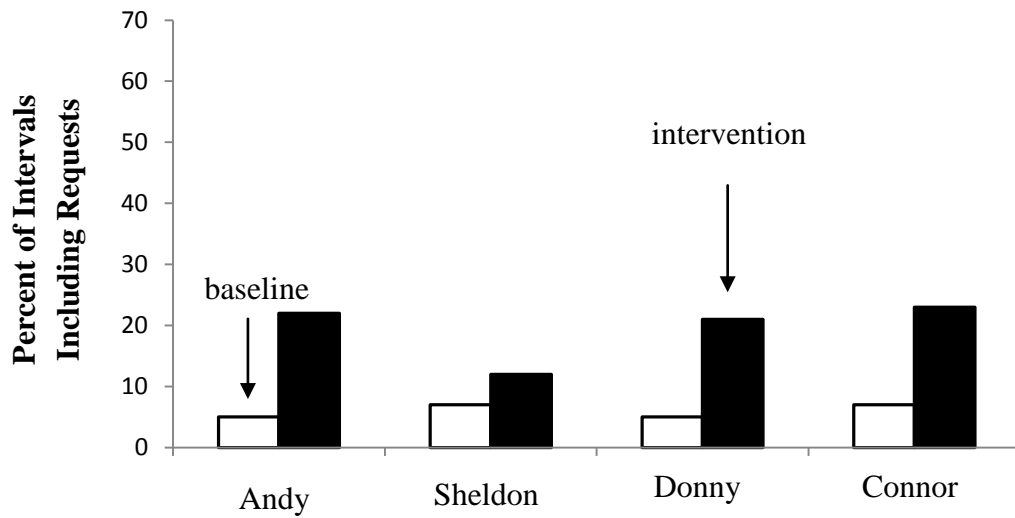


Figure 11. Mean percent of intervals during sampled sessions including participant requests across conditions.

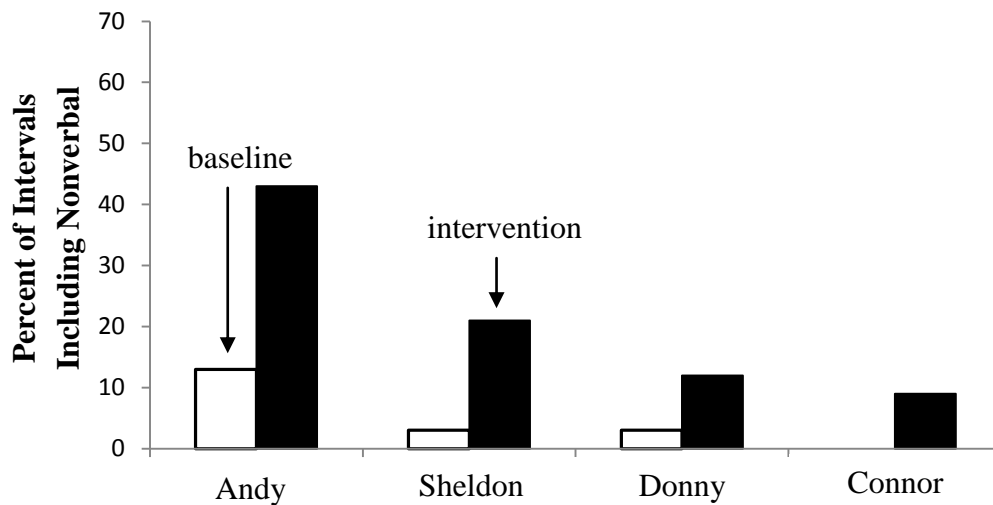


Figure 12. Mean percent of intervals during sampled sessions including participant non-verbal communication across conditions.

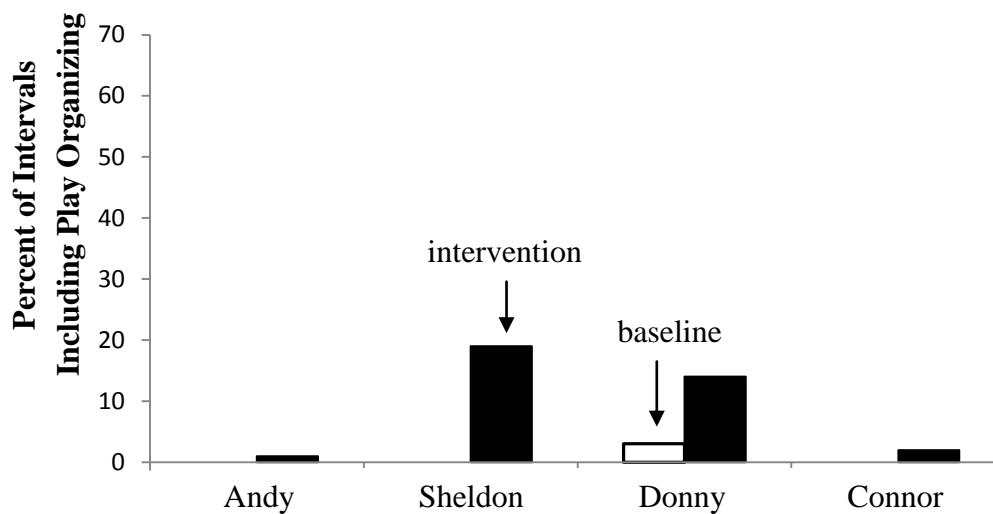


Figure 13. Mean percent of intervals during sampled sessions including participant play organizing social communication across conditions.

Appendix: Sample NOLDUS session coded for percent of intervals

missing: ~~2:31-2:59~~
4:31-4:59

suspended: 2:31-2:59
6:31-6:59, 7:00-7:30

			PI FR P				
FI	FR	F	Event Tim	Behavior	Behavior	Comment	
			Start	00:00:00	Start		
			2	00:00:00	ENG		
			3	00:00:09	PI	PLO	205bm051512smngn36
-	+	+	4	00:00:13	FR	PLO	
			5	00:00:21	PR + + +	PLO	
			6	00:00:23	FR	PLO	
			7	00:00:24	PR	RQ	
			8	00:00:32	FI	PLO	
+	-	+	9	00:00:51	FI + - +	PLO	
			10	00:00:54	PI	NIC	
			11	00:01:01	PI	PLO	
-	+	+	12	00:01:04	FR	PLO	
			13	00:01:22	PI + - +	COM	
			14	00:01:25	FR	COM	
+	-	+	15	00:01:31	FI - - -	PLO	
-	+	+	16	00:02:15	PI + - +	PLO	
			17	00:02:16	FR	PLO	
			Suspend	00:02:29	Suspend		
			Resume	00:02:50	Resume		
			21	00:02:50	ENG		
			22	00:03:03	PI	PLO	
			23	00:03:15	FI + + +	PLO	
+	+	+	24	00:03:18	PR	RQ	
			25	00:03:19	FR	COM	
			26	00:03:22	PR	PLO	
			27	00:03:24	FR	PLO	
			28	00:03:25	PR	COM	
-	-	-	29	00:03:34	PI + - +	RQ	
			30	00:03:39	PI	RQ	
+	-	+	31	00:04:27	FI	PLO	
			32	00:05:14	AF_Pt		
			33	00:05:14	FI	RQ	
+	+	+	34	00:05:18	PR	NonV	
			35	00:05:24	PI + + +	RQ	
			36	00:05:25	FR	RQ	
			37	00:05:30	FI	RQ	
			38	00:05:34	PI	PLO	
			39	00:05:37	FR	PLO	
+	+	+	40	00:05:47	FI + + +	PLO	
			41	00:05:49	PR	COM	
			42	00:05:51	FR	PLO	
			43	00:05:56	PR	PLO	
-	+	+	44	00:06:11	PI + - +	RQ	
			45	00:06:18	FI	PLO	
			Suspend	00:06:26	Suspend		
			Resume	00:07:39	Resume		
			49	00:07:39	ENG		
			50	00:07:43	PI	RQ	
-	+	+	51	00:07:44	FR + + +	PLO	
			52	00:07:47	PR	COM	
			53	00:07:59	PI	PLO	